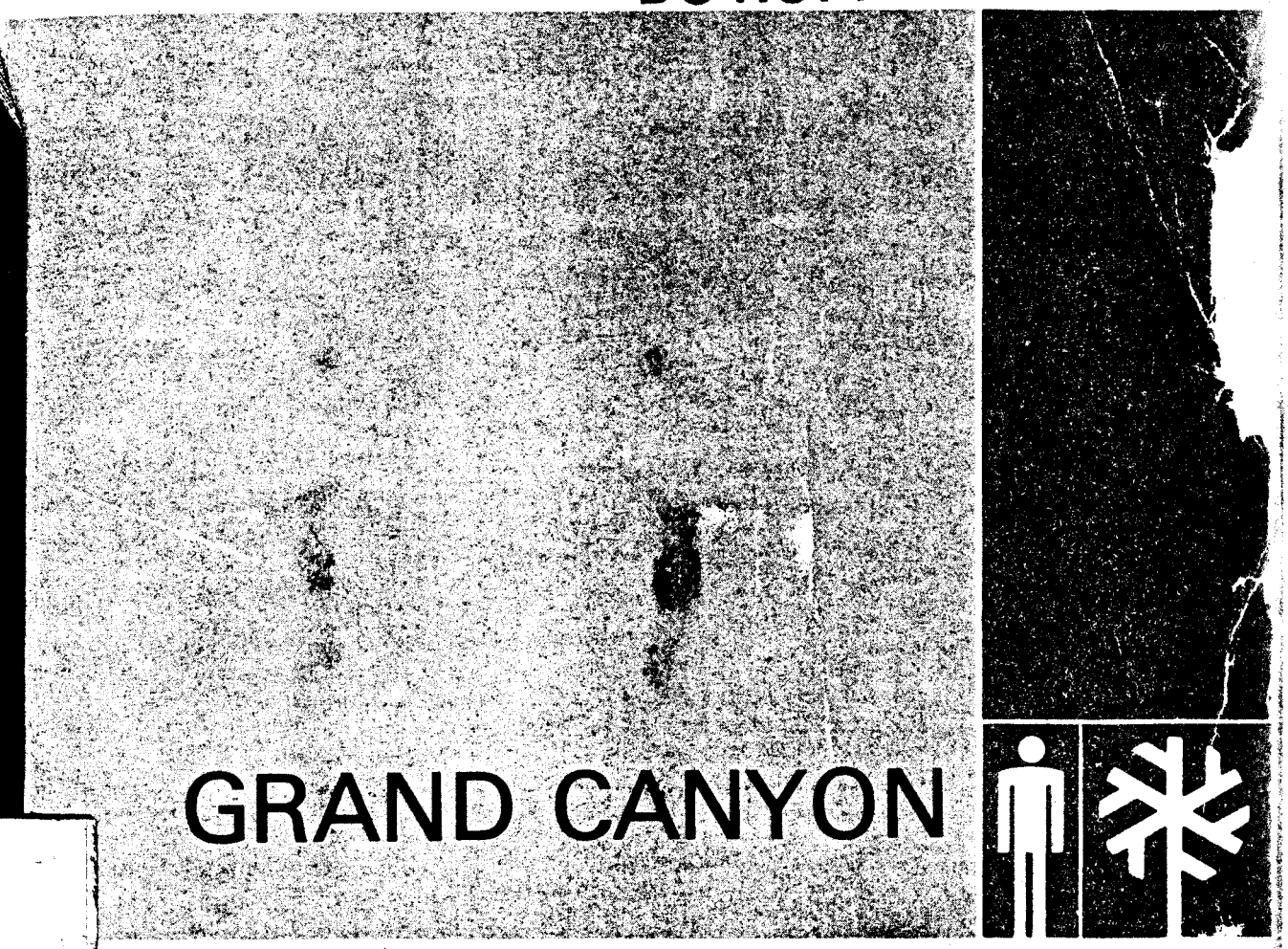
draft environmental statement

proposed wilderness classification
DES 76-28



GRAND CANYON

NATIONAL PARK / ARIZONA

DEPARTMENT OF THE INTERIOR

DRAFT

ENVIRONMENTAL STATEMENT

DES 76-28

Proposed

WILDERNESS CLASSIFICATION

for

GRAND CANYON NATIONAL PARK

Prepared by

DENVER SERVICE CENTER
NATIONAL PARK SERVICE
DEPARTMENT OF THE INTERIOR

Howard H. Chapman
Regional Director, Western Region

TABLE OF CONTENTS

Page

II. DESCRIPTION OF THE ENVIRONMENT (cont'd)

Page

Page

APPENDICES

TABLES

Page

ILLUSTRATIONS

SUMMARY

(X) Draft ( ) Final Environmental Statement

Department of the Interior, National Park Service,
Western Region, San Francisco, California

1. Type of Action: (X) Administrative (X) Legislative

2. Brief Description of Action:

   To designate as wilderness 992,046 acres of Grand Canyon National Park in Mohave and Coconino Counties, Arizona. In addition, 120,965 acres are proposed as potential wilderness additions to be added to the wilderness system at such time as the lands so qualify.

3. Summary of Environmental Impact and Adverse Environmental Effects:

   Wilderness designation will restrict management prerogatives and will limit development of visitor facilities to non-wilderness areas of the park. The action will provide increased protection from encroachment by man, and will have no adverse impact upon the natural, archeological, or historic resources of the area. Wilderness designation may affect the development of potential dam sites within Grand Canyon National Park by increased public recognition of wilderness values.

4. Alternatives Considered:

   A. No Action
   B. Less Wilderness Designation

5. Comments Have Been Requested from the Following:

   (See page xi for listing.)

6. Date Made Available to CEQ and to the Public:

   Draft Statement: JUL 19 1976
   Final Statement:

Advisory Council on Historic Preservation
Department of Agriculture
  Forest Service
  Soil Conservation Service
Department of the Interior
  Bureau of Indian Affairs
  Bureau of Land Management
  Bureau of Mines
  Bureau of Outdoor Recreation
  Bureau of Reclamation
  Fish and Wildlife Service
  Geological Survey
Department of Transportation
  Coast Guard
  Federal Aviation Administration
Environmental Protection Agency
Federal Power Commission

Arizona State Clearinghouse
  Arizona State Historic Preservation Officer
  Northern Arizona Council of Governments
Nevada State Clearinghouse
Utah State Clearinghouse

Havasupai Tribal Council
Hopi Tribal Council
Hualapai Tribal Council
Navajo Tribal Council

I. DESCRIPTION OF THE PROPOSAL

The Grand Canyon of the Colorado River dominates the physiographic and economic setting of the semi-arid plateaus and canyons of northern Arizona. It is a prepossessing physical barrier to north-south travel in this sparsely settled land, and is a prime tourist attraction for millions of visitors to the American Southwest. In 1975, 2,754,791 visitors came to view and to explore portions of the 1.2 million acres of Grand Canyon National Park which encompass this natural wonder.

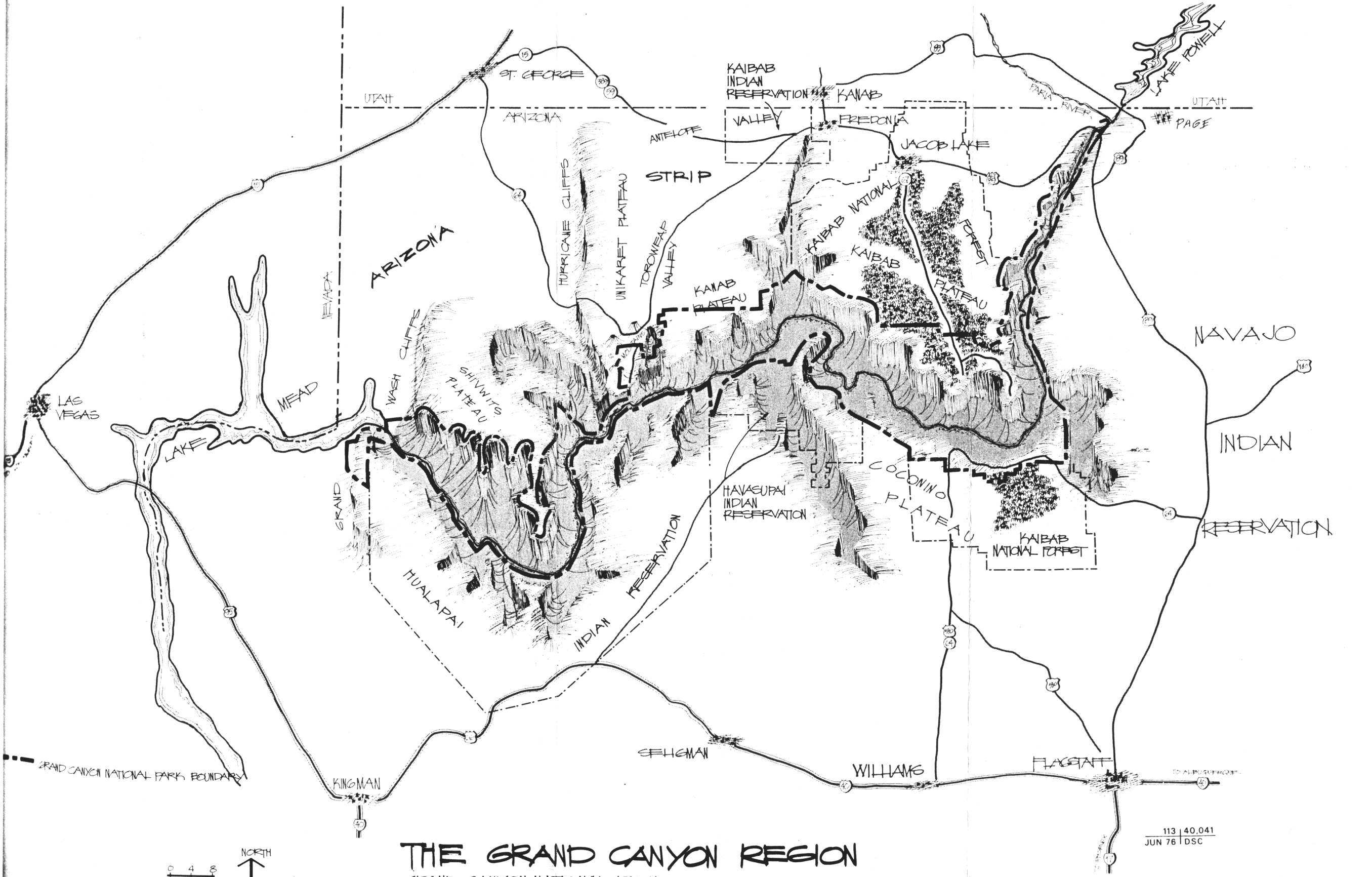
Pursuant to the Wilderness Act of 1964, the National Park Service has conducted wilderness studies, held public meetings, and developed wilderness proposals for nearly all of the lands consolidated within Grand Canyon National Park by Public Law 93-620, the Grand Canyon National Park Enlargement Act of 1975. Previous studies and environmental statements include the proposed wilderness classifications for the former Grand Canyon Complex (FES 73-68) and for portions of Lake Mead National Recreation Area now within the enlarged park (DES 74-3).

On June 10, 1975, President Ford signed into law H.R. 4109, amending the Enlargement Act to require a study of the entire enlarged park for wilderness potential. This law requires that a wilderness suitability report be presented to the President within two years of the date of enactment of P.L. 93-620, i.e., by January 3, 1977. The preliminary wilderness proposal of the National Park Service is to place 992,046 acres in wilderness; reserve 120,965 acres as potential wilderness additions; and retain 98,093 acres as non-wilderness.

A. WILDERNESS CHARACTERISTICS

Wilderness is a subjective quality that is perceived differently by each person and is therefore not subject to precise definition. However, all wilderness areas share several attributes. All are - at least in their present state - uninhabited by man and at most, only minimally disturbed by man's activities and works. All are large enough to permit the maintenance of ecosystems that contain a variety of habitats and regional biota. The Wilderness Act offers this definition for wilderness:

> "A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this act an area of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to



THE GRAND CANYON REGION

GRAND CANYON NATIONAL PARK

113 | 40,041
JUN 76 | DSC

preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geographical, or other features of scientific, educational, scenic, or historical value."

Wilderness designation usually has few immediate effects on park management as backcountry areas normally contain minimal, if any, development, and receive limited human use. Wilderness status is a deterrent to future development and consumptive uses of resources as well as restrictive on certain manipulative resource management practices. In this respect, it provides long-term protection of ecosystems and habitats - perpetuating natural processes which are relatively undisturbed by man's influences.

B. WILDERNESS STUDY AREA

The Master Plan for Grand Canyon National Park states, "Subject to the will of Congress, roadless areas will be included in the National Wilderness Preservation System." The canyon, the rims, and the river will be managed to preserve their significant resource values and to give park visitors the opportunity to see or experience the wilderness of the Grand Canyon.

One roadless study area consisting of 1,131,508 acres was studied for wilderness consideration in the Grand Canyon National Park. It is identified as Area A on the wilderness plan map. Area A essentially includes all of the park except areas of major development and major road corridors. Primitive roads not passable by ordinary highway vehicles, or closed by administrative action, are included within the roadless study area.

A large portion of the study area is below the upper rim and is the vast expanse which gave the canyon its appellation of "Grand." It has the tortuous, colorful, primitive quality which draws millions of people each year to view its spectacle. The varied vegetation and climatic conditions create an extraordinary range of environments with great scenic appeal.

Threading its way through the canyon is the Colorado River, providing a wilderness experience to thousands of visitors who run the river in rafts, boats, and kayaks each year.

On the Kaibab Plateau the study area is covered by forests of pines, spruce, fir, and quaking aspen. Deer and wild turkey are seen in the numerous grassy meadows.

The Kanab Plateau supports pinyon/juniper and sagebrush flats which contrast sharply with the expanses of the canyon which become suddenly visible at the rims. The Uinkaret Mountains rise above Toroweap Valley and Whitmore Wash and offer vast panoramic views of the canyon and surrounding plateaus.

The Sanup Plateau and the Grand Wash Cliffs were added to the park by the Enlargement Act in 1975. The Sanup is an area of seemingly endless stretches of desert scrub and flats, seldom visited except by cowboys in search of stray cattle. Rising above the Sanup to the west are the wave-like Grand Wash Cliffs, marking the extreme western edge of the Grand Canyon.

The wilderness proposal was formulated within the legislative and administrative framework provided by the Wilderness Act (Appendix A), Departmental Guidelines for Wilderness Proposals (Appendix B), and the Grand Canyon Enlargement Act (Appendix C). Land use changes pertinent to the wilderness study are described below:

Grazing - Nearly all of the former recreation area is under grazing permits, consisting of five permittees utilizing approximately 250,000 acres. The Grand Canyon Enlargement Act of 1975 requires that these permits not be renewed beyond January 3, 1985. Three lifetime grazing permits remain in effect in the Tuweep District. They will continue, as provided for in the Enlargement Act, until the death of the permittees. The lower Kanab area is under permit which expires in May 1976 and will not be renewed. (Refer to Alternative Wilderness Boundary Map for grazing locations, page VIII-4.)

Mining - Lands added to Grand Canyon National Park are no longer subject to mineral leasing. However, there are 22 parcels burdened by prior mineral reservations and railroad repurchase rights retained by Santa Fe Pacific Railway Company. All of these lands are on the fringe of the Shivwits Plateau extending onto the base of the Sanup Plateau, and no mineral locations or discoveries have been made on them. In the past, nearly all of Lake Mead National Recreation Area has been prospected, including those areas now within Grand Canyon National Park. Although closed to mineral entry, an unknown number of unpatented mining claims predate the Lake Mead establishment act. The administrative policy for

park areas of the National Park System is not to propose privately owned lands or lands on which there are privately owned interests for wilderness designation unless acquisition of such lands or interests by the United States is assured.

Non-Federal Lands - There are 1,478 acres of private land and 1,680 acres of state land within the park's boundary. Acquisition of these lands is being actively pursued with the objective of ultimate Federal ownership of all lands and all reservations within the park's boundaries. State lands will be acquired only by donation or exchange according to Public Law 93-620. The State of Arizona has indicated its desire for an exchange of its lands within the park for other Federal lands.

Hydroelectric Potential - The Enlargement Act retains existing reclamation provisions. No dams may be built in Grand Canyon National Park on the Colorado River without explicit Congressional authorization. The Secretary of the Interior, however, may authorize lesser developments related to reclamation projects on the former Lake Mead lands now in Grand Canyon.

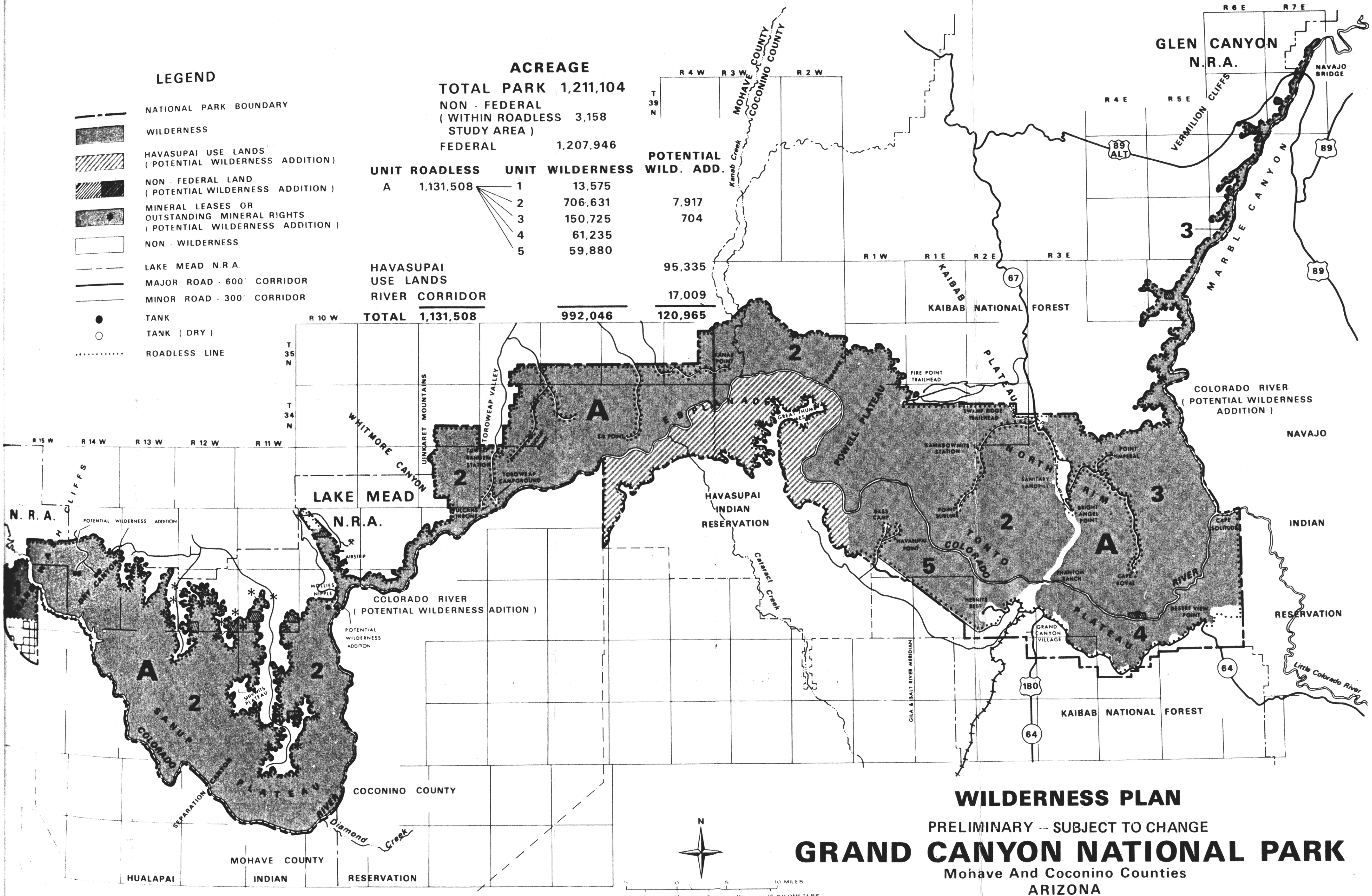
C. PROPOSED WILDERNESS AREAS

Five units totaling 992,046 acres are being proposed for wilderness designation in Grand Canyon National Park. This amounts to approximately 82 percent of the park's total area. All of the park's physiographic and biotic elements are represented within these units.

TABLE 1

Proposal Acreage Summary

Unit	Roadless	Unit	Wilderness	Potential Wilderness Additions
A	1,131,508	1	13,575	
		2	706,631	7,917
		3	150,725	704
		4	61,235	
		5	59,880	
Havasupai Use Lands				95,335
River Corridor				17,009
Total	1,131,508		992,046	120,965


LEGEND
NATIONAL PARK BOUNDARY
WILDERNESS
HAVASUPAI USE LANDS (POTENTIAL WILDERNESS ADDITION)
NON - FEDERAL LAND (POTENTIAL WILDERNESS ADDITION)
MINERAL LEASES OR OUTSTANDING MINERAL RIGHTS (POTENTIAL WILDERNESS ADDITION)
NON - WILDERNESS
LAKE MEAD N.R.A.
MAJOR ROAD - 600' CORRIDOR
MINOR ROAD - 300' CORRIDOR
TANK
TANK (DRY)
ROADLESS LINE
ACREAGE
TOTAL PARK 1,211,104
NON - FEDERAL (WITHIN ROADLESS STUDY AREA) 3,158
FEDERAL 1,207,946
UNIT ROADLESS | UNIT WILDERNESS | POTENTIAL WILD. ADD.
A 1,131,508
1 13,575
2 706,631 7,917
3 150,725 704
4 61,235
5 59,880
HAVASUPAI USE LANDS 95,335
RIVER CORRIDOR 17,009
TOTAL 1,131,508 992,046 120,965
GLEN CANYON N.R.A.
NAVAJO BRIDGE
VERMILION CLIFFS
MARBLE CANYON
MOHAVE COUNTY
COCONINO COUNTY
Kanab Creek
KAIBAB NATIONAL FOREST
KAIBAB PLATEAU
FIRE POINT TRAILHEAD
COLORADO RIVER (POTENTIAL WILDERNESS ADDITION)
NAVAJO
INDIAN
RESERVATION
Little Colorado River
POWELL PLATEAU
NORTH RIM
TONTO
COLORADO
RIVER
PLATEAU
GRAND CANYON VILLAGE
HAVASUPAI INDIAN RESERVATION
Cataract Creek
TOROWEAP VALLEY
UINKARET MOUNTAINS
WHITMORE CANYON
LAKE MEAD N.R.A.
COLORADO RIVER (POTENTIAL WILDERNESS ADITION)
POTENTIAL WILDERNESS ADDITION
AIRSTRIP
MOLLIES NIPPLE
SHIVWITS PLATEAU
SANUP PLATEAU
SEPARATION CANYON
Diamond Creek
COCONINO COUNTY
MOHAVE COUNTY
HUALAPAI INDIAN RESERVATION
GILA & SALT RIVER MERIDIAN
N.R.A.
CLIFFS
DRY CANYON
WILDERNESS PLAN
PRELIMINARY -- SUBJECT TO CHANGE
GRAND CANYON NATIONAL PARK
Mohave And Coconino Counties
ARIZONA
113 | 40,045
DSC | JUNE 76

1. Unit 1

This unit, consisting of 13,575 acres, contains the Grand Wash Cliffs escarpment on the south side of the Colorado River in the extreme western portion of the park. It is bounded on the north by the south high-water line of the stillwater portion of the Colorado River where it enters Lake Mead; on the west by the park's western boundary; on the south by the north boundary of sections 31, 32, 33, T.31N., R.15W., and on the east by the boundary of the Hualapai Indian Reservation. The area south of the wilderness boundary contains a conglomerate of private, state, and subdivided lands with a multitude of owners.

The area is grazed, but mechanical maintenance or vehicular traffic is not required in this segment of the grazing permit.

2. Unit 2

Approximately 706,631 acres are included within this large area. All of the natural and geographic wonders of the Grand Canyon, its associated side canyons, plateaus and mountain ranges are well represented within this proposed wilderness unit.

The unit is bounded on the north by the park boundary; on the west by the park boundary; on the south it is bounded by a line from river mile 277 to river mile 238.5 to a point approximately 0.1 of a mile west of the confluence of Bright Angel Creek; on the east by a rim 0.1 mile west of Bright Angel Creek and paralleling it to a ridge ascending to Bright Angel Point, then following the north rim to a point 0.1 of a mile southwest of Bright Angel Spring, then due northwest a distance of 1.2 miles then due north 4.5 miles to a line 300 feet west of the center-line of Highway 67 and paralleling it to BM 8827, then due west a distance of 1.75 miles, then northwesterly to a line on the east edge of Fawn Spring intersecting the north boundary.

Special consideration of problems particular to each of the geographic areas is necessary for clarity. Therefore, the unit will be described by physiographic regions.

a. Sanup Plateau

The broad expanse of this plateau is flanked on the north by the towering cliffs of the intruding Shivwits Plateau. From the south side, canyons probe the interior of the plateau. Included are the well-known Separation Canyon and nearby Surprise Canyon. The contrasting cliffs looming above and the incised canyons providing views below allow for an isolated viewing experience in an area that has always been wilderness.

Potential wilderness additions consist of approximately 1,152 acres of private land; 1,302 acres of state land; and 4 road corridors about 8 miles in length that provide access to 6 dirt water catchments and one steel tank. The roads will remain open to allow for mechanical maintenance of the stock watering locations until the grazing permits expire on January 3, 1985, as provided for by the Grand Canyon Enlargement Act.

b. Uinkaret Mountains

The southern extension of this range, sometimes referred to as the Pine Mountains, contains peaks in excess of 7,000 feet, offering a contrast in elevation to the Colorado River bed 6,000 feet below. Pine forests grow on the north facing slopes with an occasional patch of Douglas fir. The area is noted for its fine deer habitat. Panoramic views of the Grand Canyon region are available from the higher points along the range.

Approximately three miles of primitive roads have been designated for closure by park management.

Included within this area is Slide Mountain, which is one of three parcels presently being Congressionally evaluated for National Park suitability or possible deletion from the park. Since it is still part of the park at this time, it is deemed satisfactory for a wilderness designation.

c. Toroweap Valley

This geographic area is bounded by the picturesque Uinkaret Mountains on the west and by the limestone Toroweap Cliffs on the east, rising 2,000 feet above the valley floor. Historically, this flat sagebrush-grassland has been heavily grazed and has also been manipulated by man to prevent sheet erosion.

Grazing does occur, but is not supported by man-made intrusions. Grazing will cease with the expiration of a lifetime permit. About 10 miles of primitive roads will be administratively closed and allowed to return to a natural state.

The minor road corridor through Toroweap Valley, six miles in length, and the Toroweap Campground together with the corridor on the west side of Vulcans Throne, two miles in length, and the Toroweap Ranger Station will be excluded from a wilderness designation.

d. Tuckup Point

This area is characterized by flat to gently rolling expanses of pinyon-juniper. These lands offer support and present a contrast to the Esplanade and inner canyon. The extension of wilderness to these uplands

provides an uninterrupted wilderness through an area preserved for its primitive natural character and geological significance.

Tuckup Point is grazed in the northern sections under a single permit. Water catchments and primitive access roads support this activity. Grazing occurs on the entire point due to the absence of fences. It is proposed that two minor road corridors, about 16 miles in length, be retained, one to the Tuckup Canyon Trailhead and the other to Toroweap Point Overlook. Three of the four active stock water catchments are within this corridor. These corridors will provide access for catchment maintenance. When the lifetime grazing permit expires, all other roads, totaling 16 miles, and four water catchments will be allowed to return to a natural condition. With the exception of the road corridors, the entire point is proposed as wilderness.

Portions of Tuckup Point could be affected by Congressional action determining the suitability of these lands for retention in the park.

e. SB Point

SB Point offers the same setting and relation to the Esplanade and inner canyon afforded by Tuckup Point. The old Jensen Tank grazing allotment is not currently under a grazing permit. However, cattle indiscriminately graze the point since the north boundary is not fenced.

A minor road corridor, nine miles in length, to SB Point Overlook will provide trail access to 150 Mile Canyon and the Esplanade. In addition, a minor access road corridor about nine miles in length and an overlook at Kanab Point will be excluded. Eleven miles of primitive roads will be administratively closed and one water catchment will be returned to a natural state.

Congressional action on the suitability study now before Congress could also affect this wilderness proposal.

f. North Rim

The relatively cool and wet Kaibab Plateau, abounding with deer and turkey, will offer a wilderness area where the solitude of the forests can be enjoyed, complementing wilderness proposed in the desert areas which surround the plateau.

Fire management is now being applied on the North Rim to reduce the buildup of fuels which have accumulated during 70 years of fire suppression. This change in management philosophy is allowing the closure of 63 miles of roads previously needed for fire control purposes.

The Point Sublime Road will be retained in a primitive state with a 300-foot-wide corridor through the wilderness unit. Point Sublime will also be excluded for the purpose of providing an overlook site.

The Kanabanowits station adjacent to the Point Sublime Road will be excluded from wilderness to provide a backcountry station for visitor protection, backcountry patrol and maintenance.

Fire Point is not proposed for wilderness to allow for motorized trailhead access to Powell Plateau. Another trailhead will be provided at Swamp Ridge just south of the park boundary. A minor access corridor one mile in length and the sanitary landfill will be excluded from wilderness.

Access to the interior of the North Rim will be by foot, horseback, or by helicopter should it be necessary to control fires that may endanger human life, property, or adjacent lands.

g. Esplanade

The Esplanade is the broad plateau that extends from the base of the limestone cliffs to the rim of the red rock of the inner canyon. It is subdivided by numerous side canyons extending north from the main artery of the inner canyon.

Grazing still occurs on portions of the area. However, when the current lifetime permits expire, grazing will terminate. There are no man-made intrusions that support grazing on the Esplanade.

h. Tonto Plateau

The flattest continuum on both sides of the inner gorge of the Colorado River in the central and eastern portions of the park is the Tonto Plateau. It is more than a mile in width in many places and is a major portion of the proposed wilderness in Units 2, 3, 4, and 5. It lies predominantly below an elevation of 4,500 feet and is cut by numerous canyons tributary to the Colorado River. No uses or development intrusions outside of the cross-canyon corridor on the Tonto Plateau are contrary to wilderness qualification.

i. Inner Canyon

Within the near-vertical walls of the inner canyon and arterial side canyons flows the lifeblood and creator of the Grand Canyon. Tributaries feed the mighty Colorado River as they have through eons of time, providing force to the cutting edges of soil suspended in the rushing water. Red rock walls of changing colors provide a curtain that encompasses the gorge to the rim of the Esplanade.

Man passes through this area and enjoys its splendor primarily from the river surface. The footprints of man are recorded here but he has not noticeably affected this corridor.

3. Unit 3

The main features of this proposed 150,725-acre wilderness are Marble Canyon, the North Rim area and associated viewing points east of Highway 67, and the inner canyon region with its numerous plateaus, shrines, thrones, gates, temples and other colorful names which add to the breathtaking beauty of the Grand Canyon. Vertical spires of red rock, canyons of changing moods and steep valleys winding between these obstacles typically describe an area that thousands of words have been written about and numberless photographers have attempted to capture. Marble Canyon includes the narrow northeasterly segment of the unit where the Colorado River is seemingly confined in comparison to the broad expanse of erosional remnants found beyond Nankoweap Rapids.

The wilderness unit is bounded on the north by the park boundary to a point on the boundary 1.0 miles east of BM 8801 then south 0.6 of a mile then west 0.6 of a mile to a line in a southeast-to-northwest orientation 0.3 of a mile east of BM 8737 extending through BM 8801; on the west by the above described orientation about 4.8 miles south intersecting a point 300 feet north of the centerline of Highway 67 and paralleling the highway south to Roaring Springs Canyon then to Roaring Springs; then paralleling Bright Angel Creek a distance of approximately 0.1 of a mile east to a point approximately 0.5 of a mile northeast of the mouth of Bright Angel Creek on the high-water line of the north bank of the Colorado River; on the south by the high-water line of the Colorado River; on the east by the high-water line of the Colorado River to the confluence of the Paria River; and finally by the west boundary of the park along the rim of Marble Canyon to the north boundary of the park.

a. Marble Canyon

Potential wilderness additions consist of five tracts of state land totaling 378 acres. The State of Arizona has indicated its desire to exchange these tracts for other Federal lands outside the park.

b. Inner Canyon

A 326-acre private tract near Sockdologer Rapids will be included as a potential wilderness addition.

c. North Rim

The area described is east of Highway 67. Excluded from wilderness will be major road corridors to Point Imperial and to Cape Royal, including

the point. Approximately 25 miles of fire control roads will be administratively closed in this portion of the North Rim.

4. Unit 4

Within its 61,235 acres, this area includes the Grand Canyon from the Little Colorado River to the Cross-Canyon Corridor and between the Colorado River and the South Rim. Included are the Palisades of the Desert and Cape Solitude on the eastern edge of the park and a portion of the canyon overlooked by the popular East Rim Drive.

This unit is located in the southeast portion of the park. It is bounded on the north by the south bank of the Little Colorado River and by the high-water line of the Colorado River's south bank to a point about 1.75 miles east of Garden Creek, where the boundary parallels the river at a distance of 330 feet south of the high-water line until reaching a point about 200 feet east of Garden Creek; then on the west by a line generally 0.1 mile east of Garden Creek until intersecting the ridge line that ascends to Yavapai Point on the South Rim; on the south by the South Rim and Straight Canyon; and on the east by the park boundary.

The road corridor of 12 miles to Cape Solitude has been excluded from the administrative road system for Grand Canyon National Park. Therefore, since it is closed, it will not be in conflict with a wilderness designation for this area.

5. Unit 5

This unit, containing 59,880 acres, includes the spectacular scenery of the canyon north of the South Rim to the river corridor and the plateau lands south of the rim.

This wilderness unit is bounded on the north by the high-water line on the south bank of the Colorado River beginning at a point approximately 0.6 of a mile east of Horn Creek and extending to the Havasupai Traditional Use Lands; on the west by the boundary of the Havasupai Use Lands; on the south by the park boundary to the access road to Pasture Wash Ranger Station a distance of approximately 660 feet due west of BM 6296 paralleli the road, until intersecting the boundary road 1,650 feet north of BM 6296, and then paralleling this road from that point north of the south boundary of the park; then from BM 6256 a distance of 150 feet north and paralleling this road to a point approximately one mile east of BM 6456 to the 1/16 line in Section 29, then north to the South Rim, then following the South Rim to Powell Point; on the east by the ridge extending from Powell Point to the inner canyon rim to BM 3702 then north.

Excluded from wilderness will be the Pasture Wash Ranger Station and a minor road corridor six miles in length to Bass Trailhead and to Havasupai Point. In addition, an area for a trailhead and an overlook will be excluded.

D. POTENTIAL WILDERNESS ADDITIONS

A special provision is recommended in the legislation establishing a Grand Canyon wilderness that will give the Secretary of the Interior the authority to designate the following areas as wilderness at such time he determines they will qualify.

1. River Corridor

Two hundred seventy-seven miles of the Colorado River are within Grand Canyon National Park. There is no question that the river passes through some of the most scenic and primitive land remaining in this country. Motorized boat use on the river is not necessary for access to, and enjoyment of, this area. It is a convenience which enables the trip to be made in less time and permits the use of larger boats and thus accommodates larger groups. Because of the use of motors on the river it is not being proposed for wilderness designation.

It is proposed that the river corridor be designated a potential wilderness addition. From mile 277 at the Grand Wash Cliffs extending to the mouth of the Paria River, the high-water line of the Colorado River will be the boundary. The total area, including the water surface, is approximately 17,009 acres.

2. Havasupai Traditional Use Lands

The Grand Canyon Enlargement Act, P.L. 93-620 Sec. 10 (e) states, "The Secretary, subject to such reasonable regulations as he may prescribe to protect the scenic, natural, and wildlife values thereof, shall permit the tribe to use lands within the Grand Canyon National Park which are designated 'Havasupai Use Lands.'" This legislation appears to preclude man-made developments that would intrude on the natural landscape or that would be contrary to wilderness designation.

This unit, consisting of 95,335 acres of Havasupai Use Lands (typical of the rugged qualities of the Grand Canyon), is proposed as a potential wilderness addition, pending the outcome of the study currently being headed by the Bureau of Indian Affairs, together with the Havasupai Tribe and the National Park Service. The study will determine what traditional uses were made of this land by the Havasupai and whether or not such uses are compatible with wilderness designation.

Grazing has traditionally occurred on this entire acreage without the intrusion of the works of man such as water tanks, roads, etc. It is

likely that this use will continue in this traditional manner. Such use may be included in proposed wilderness. (See Appendix B.)

3. Inholdings and Outstanding Rights and Reservations

Areas designated in the master plan for future management as primitive backcountry, but not now qualifying as wilderness because of conflicting uses or interests, can be proposed as potential wilderness additions when the areas will qualify, within a determinable time, and become available Federal land.

Most of the non-Federal lands occur in the Sanup Plateau area or in Marble Canyon, with one exception being the private property at Sockdologer Rapids. The 22 parcels of outstanding mineral reservations and railroad repurchase rights of the Santa Fe Railroad Company amounting to 5,500 acres are also located on the base of the Sanup Plateau adjacent to the Shivwits Plateau. These tracts consist of 1,478 acres of private land, 1,680 acres of state land, and 5,500 acres of outstanding rights, of which 220 acres are also privately owned. All of these tracts are proposed as potential wilderness additions, since the intent is to acquire the parcels or outstanding rights.

4. Grazing Access Corridors

Grazing occurs on limited acreages within the canyon (presently 250,000 acres are subject to grazing - see page I-4). Where it does occur it is essential to maintain existing water catchments. Maintenance of this type requires vehicular access in areas that would otherwise be proposed for wilderness. In lieu of the expiration of the grazing permits it is recommended that these corridors, about six miles in length and averaging about 300 feet in width (totaling 183 acres), be proposed as potential wilderness additions.

E. REPEAL OF RECLAMATION PROVISION (Section 9(b), Public Law 93-620)

The Enlargement Act authorizes the Secretary of the Interior to permit the utilization of those areas formerly within the Lake Mead National Recreation Area which may be necessary for the development and maintenance of a Government reclamation project to meet the energy needs of the Southwest.

Section 9(b) does not preclude an area from being designated as wilderness. However, minor reclamation projects, such as those related to maintenance or extension of water or power developments and transmission lines, could eliminate wilderness characteristics of lands so designated. Therefore, it is recommended that the reclamation provision be removed by amendment, simultaneously with legislation designating wilderness areas, from the Grand Canyon National Park Enlargement Act of 1975, thus placing reclamation activities in the national park under the will of Congress.

F. NON-WILDERNESS AREAS

Excluded from the preliminary wilderness proposal are 98,093 acres designated as non-wilderness areas. The proposal does not close the canyon to current uses, but rather assures that the rugged scenic qualities of the canyon will be preserved for all those who view it but may never enter its challenging and desolate interior. Provided for in the preliminary plan are corridors for retaining primitive road access for canyon viewing opportunities at such locations as Toroweap Point, Kanab Point, Tuckup Point, SB Point, Havasupai Point, and Point Sublime. Access is also provided to selected trailheads such as those found at Tuckup Canyon, 150 Mile Canyon, and Fire Point. In addition, trail access is also provided to numerous overlooks for canyon viewing in relative solitude. The Bright Angel Corridor provides a backcountry experience through the heart of the canyon.

The areas excluded from wilderness primarily include the North and South Rim areas that are intensively developed for visitor use. Development will continue within these impacted areas. Areas south of Grand Canyon Village adjacent to Units 4 and 5 have been excluded due to intensive use which has left the imprint of man in the form of numerous roads, utility corridors, and a railroad route.

Access over paved roads is provided to the traditional viewing areas such as the North Rim, Desert View, South Rim and West Rim Drive.

The extreme southern portion of the Grand Wash Cliffs addition to the park is recommended as non-wilderness owing to the large number of private inholdings there which have been subdivided for development.

The wilderness proposal is not restrictive on traditional activities in the park such as viewing the canyon. It allows them to occur where they have in the past - in non-wilderness areas. It also retains primitive access corridors to viewing points and to trailheads which provide access into the wilderness.

G. INTERRELATIONSHIP TO OTHER PLANS AND PROPOSALS

1. River Use

The goals for management of the Colorado River through Grand Canyon are to perpetuate the river-running wilderness experience and to attempt to mitigate the impact of man's upstream manipulation of the river's water.

The use of motors on the river, the accelerating interest in river running, the increasing influences of regulated flow, and upstream aquatic manipulations combine to make these management goals difficult to achieve, for their impacts are as yet not fully recorded or understood. Enough is known, however, so that more intensive management of the recreational use and management of the ecosystems may begin.

The outcome of various research projects, as well as public input, will result in a River Management Plan. Until this plan is completed, and a management decision made regarding motorized use on the river, the river corridor is shown as potential wilderness.

2. Havasupai Reservation Land Use Plan

Public Law 93-620, Section 10(b) (refer to Appendix C) requires that a study shall be made by the Secretary of the Interior in consultation with the Havasupai Tribal Council to develop a plan for the use of 185,000 acres of land included in the Havasupai Reservation. The land may be used for traditional religious purposes, for the hunting and gathering of native foods, for agricultural and grazing purposes, and for the development of tribal small business enterprises. The plan shall include the selection of areas which may be used for residential, educational, and other community purposes for members of the tribe and which shall not be inconsistent with or detract from park uses and values.

The reservation lands are adjacent to the boundary and in the Great Thumb area, which are virtually surrounded by the park. Housing, intensive grazing, road development or irrigation could affect adjacent wilderness proposals if these developments require access across park lands. Any wilderness classification will be developed in conjunction with Havasupai Reservation plans to assure understanding and continuity.

3. Park Boundary Studies

Pursuant to Section 3(c) of Public Law 93-620, the National Park Service has completed a study of lands commonly known as Tuckup Point, Slide Mountain, and Jensen Tank within Grand Canyon National Park to determine whether any portion of these lands might be unsuitable for park purposes. The study report, Park Suitability Study (February 1976), has been submitted to the Congress through the Secretary of the Interior, recommending that the public interest will best be served by retaining the above areas within Grand Canyon National Park.

These areas have been proposed for wilderness; the status would change if Congress determines these lands are not suitable for park purposes and the public interest could be better served by their deletion.

House Report 12136, December 17, 1974, makes specific reference to possible future additions to the park: Upper Kanab Creek; portions of Parashant and Andrus Canyons and Whitmore Wash; and bordering portions of the Shivwits Plateau. The Committee of Conference directs the Secretary of the Interior to study these areas to determine if they, or any part of them, qualify for national park designation. Once this study is completed, it is to be transmitted, together with his recommendations to the Congress, for its consideration.

The date for completion was not specified. However, any future study followed by Congressional action favoring addition could change the wilderness recommendation considerably with regard to boundaries and additional acreages.

The contiguous boundary of the Lake Mead National Recreation Area and Grand Canyon National Park along the north side will be considered where developing a mutual wilderness boundary. Recent mining leases granted to Exxon in the vicinity of Whitmore-Parashant-Andrus tributaries may have an effect on the proposed Lake Mead wilderness boundary and correspondingly the proposed Grand Canyon wilderness.

4. Grand Canyon National Park Master Plan

The master plan and final environmental statement (FES 75-97) have been completed and made available to the public for review. The wilderness study was developed in conjunction with the master plan proposals and takes into consideration access, visitor protection, interpretive facilities, resource management, and general development needs.

The r
run
ac
•

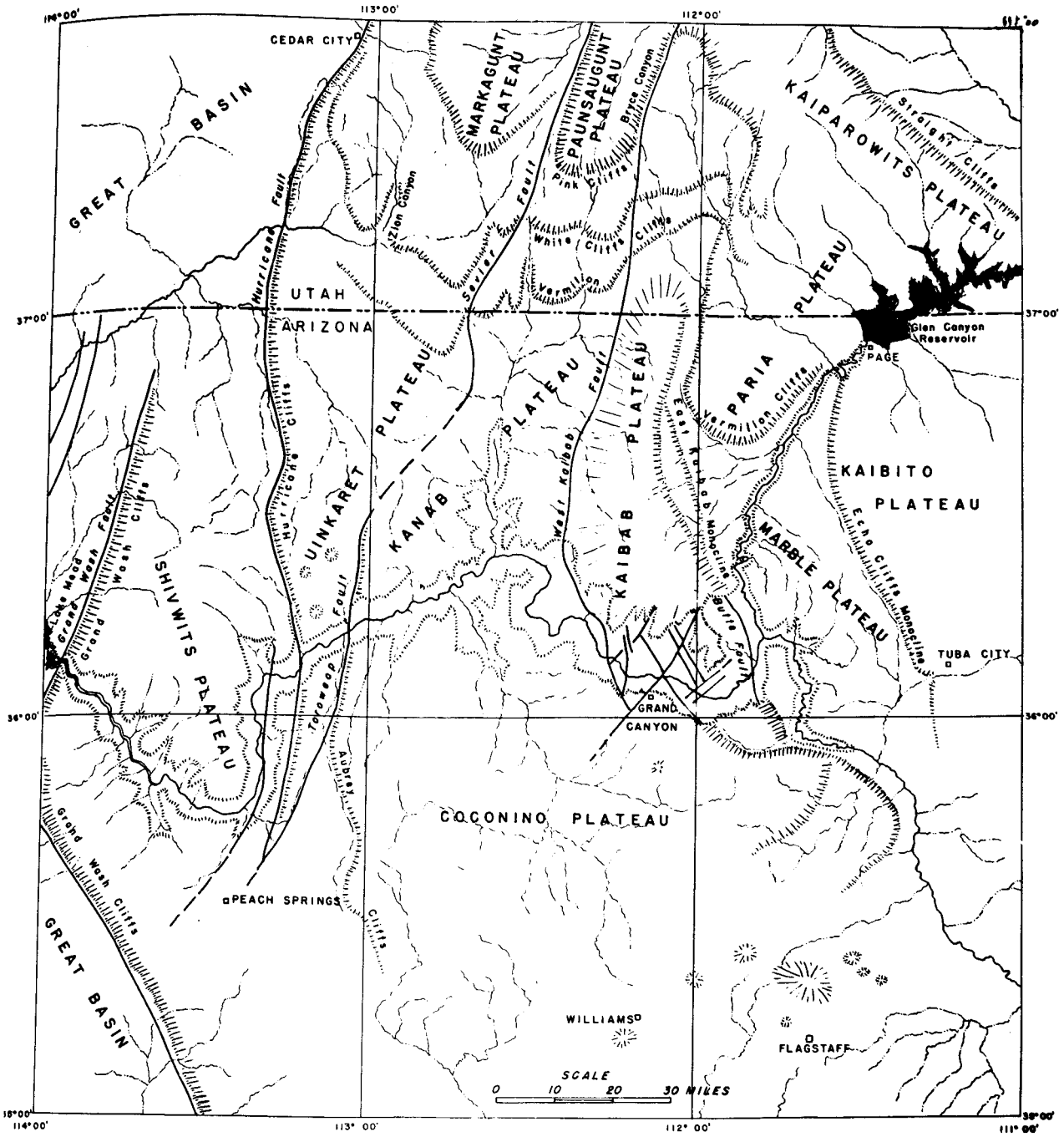
OF THE ENVIRONMENT

_s of Grand Canyon National Park lie adjacent to the
_ver in northern Arizona. The park extends for 277 miles
_o the Arizona portions of the Colorado River, from Glen Canyon National Recreation Area at Lees Ferry to the Grand Wash Cliffs. The park, thus, extends east-west across the southern portion of the Colorado Plateau; a vast, semi-arid land of raised plains and basins. Dividing the park into north and south portions is the 217-mile-long Grand Canyon, which ranges from 1 to 25 miles in width and is up to one mile in depth. The 60-mile-long Marble Canyon forms the eastern boundary of the park and extends the entity known as "Grand Canyon" to a total length of 277 miles. Elevation within the park ranges from 1,200 feet at the western portion where the Colorado River enters Lake Mead, to 9,165 feet on the North Rim. Lake Mead National Recreation Area adjoins the park along its western boundary. P.L. 93-620, dated January 3, 1975, incorporated Marble Canyon National Monument; Grand Canyon National Monument; portions of Lake Mead National Recreation Area, the Kaibab National Forest, national resource lands (Bureau of Land Management); and other lands into the present park.

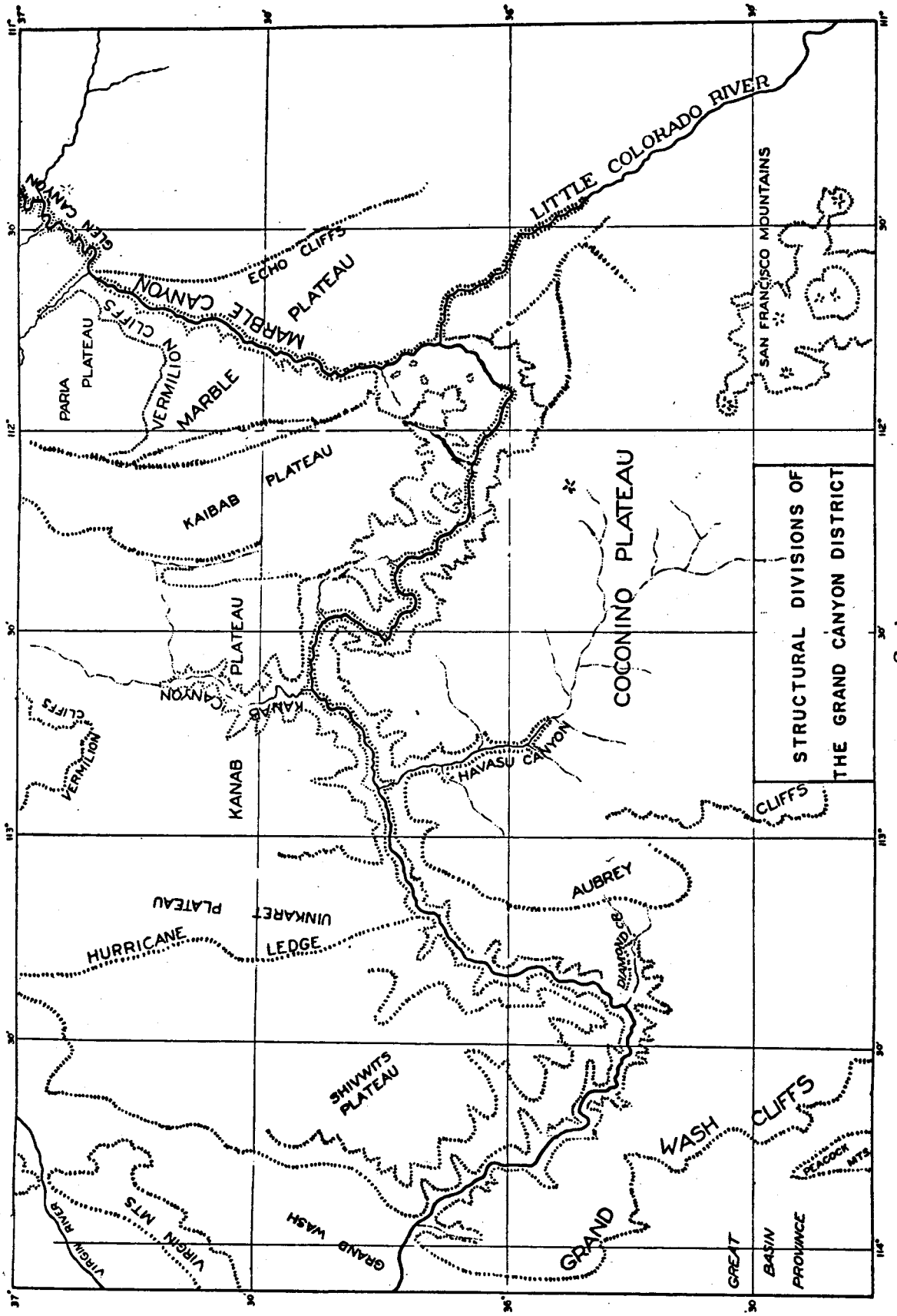
B. GEOLOGY

The Grand Canyon lies in the physiographic region known as the Colorado Plateau, or the Plateau Province. The Colorado Plateau includes southwestern Colorado, southeastern Utah, northwestern New Mexico and north central and northeastern Arizona. It is characterized by a thick sequence of flat to gently dipping sedimentary rocks that erode into majestic plateaus and mesas separated by deep canyons. The Colorado Plateau is a stable region with few earthquakes and its surface rocks have undergone very little deformation in comparison to other portions of southwestern United States. See page II-2 for a physiographic map covering the Grand Canyon region, and page II-3 for its structural divisions.

The mile-deep Grand Canyon is the deepest and most extensive canyon found in the plateau country. It is a geologic timepiece studied by both scientists and laymen, and it is a world-renowned scenic spectacle. The exposed rock layers represent all of the eras of geologic time and contain evidence of the evolution of life through more than 600 million years of earth history. The oldest dated rocks in the Inner Canyon approach 2,000 million years in age and, thus, the observer comes metaphorically face to face with the beginnings of time. See page II-5 for a generalized cross section of the canyon, and Appendix D for a summary of its geologic history.



PHYSIOGRAPHY--GRAND CANYON REGION


LITTLE COLORADO RIVER
GLEN CANYON
ECHO CLIFFS
MARBLE CANYON
PLATEAU
PARIA PLATEAU
VERMILION CLIFFS
MARBLE
SAN FRANCISCO MOUNTAINS
KAIBAB PLATEAU
COCONINO PLATEAU
KANAB CANYON
KANAB PLATEAU
VERMILION CLIFFS
HAVASU CANYON
STRUCTURAL DIVISIONS OF THE GRAND CANYON DISTRICT
CLIFFS
AUBREY
UINKARET PLATEAU
HURRICANE LEDGE
DIAMOND CR.
SHIVWITS PLATEAU
GRAND WASH CLIFFS
PEACOCK MTS.
VIRGIN RIVER
VIRGIN MTS
GRAND WASH
GREAT BASIN PROVINCE
Scale
0 5 10 20 Miles

In a planimetric sense, all of the individual plateaus within the Plateau Province are elongated in a north-south direction and bounded on the east and west by sharp structural breaks and folds. These major zones occur at intervals ranging from 15 to 40 miles apart across northern Arizona. In carving the Grand Canyon, the Colorado River cut a clean, east-west cross section through several of these plateaus, providing a window through which the geologic history of the region may be viewed.

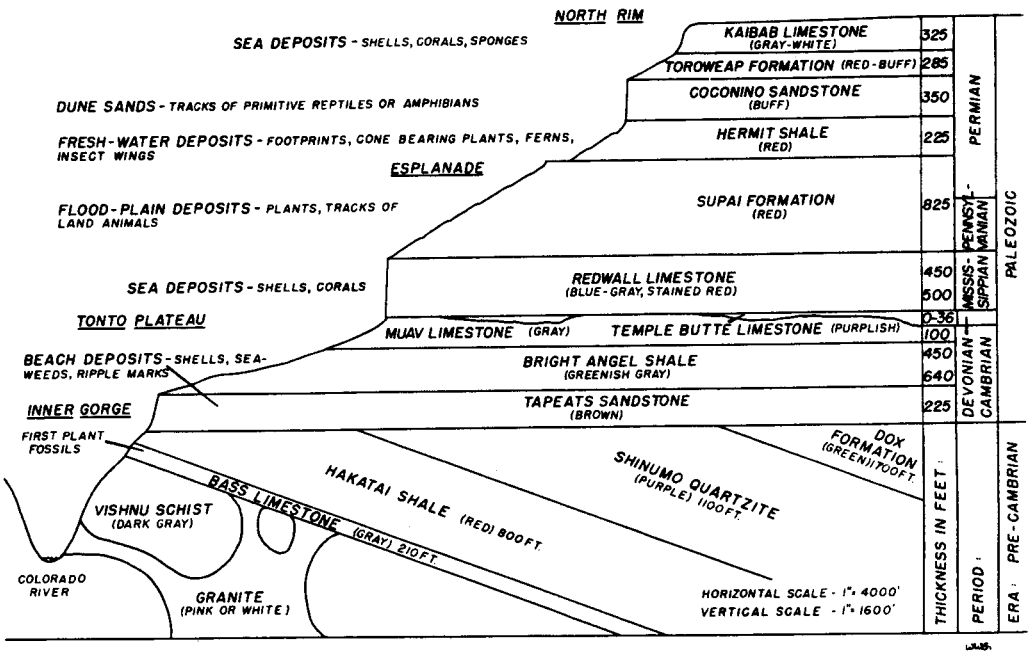
The central and eastern portions of the park are in an area of relatively low seismic activity, and the probability of a destructive earthquake is low. Three or four minor quakes have occurred in this century, but damage has been negligible.

The backcountry and off-trail hiker is subject to a number of geologic hazards. Chemical weathering is minimal in the semi-arid climate of the canyon and horizontal strata erodes into a series of alternating steep slopes and near-vertical cliffs. The metamorphic rocks of the deep inner canyon present a relatively uniform face to erosion and form nearly unclimbable cliffs and steep, jagged slopes. This rugged topography provides ample opportunity for off-trail hikers and climbers to become trapped on ledges or to fall from them. The climate, isolation, and heights involved often make such errors fatal.

The progressive widening of the canyon is largely due to rockfalls. These rockfalls are usually the cumulative result of several agents and may occur near cliff faces at any time. Heavy rains produce highly erosive surface runoff that cascades down the canyon walls, scouring and dislodging rock material. Ground water movement can erode and subvert promontories and surface rocks, causing them to collapse or fall into the depths of the canyon. Easily eroded strata, such as shale, erodes more rapidly than overlying rocks, undermines them, and causes their collapse. Water entering joints and cracks from melting snow and ice on warm winter days will freeze and the consequent expansion in volume causes tremendous pressure and may cause portions of the canyon walls to flake off. Similarly, the pressures exerted by developing plant roots may be sufficient to dislodge huge boulders and cause instability in rocks near the canyon rim. Deaths and injuries have occurred from being in the path of this natural process of erosion.

C. MINERAL POTENTIAL

The mineral potential of Grand Canyon is not known in any detail. The first American prospectors entered Grand Canyon in 1874 and hundreds of claims were located between then and the establishment of the national park in 1919. Small deposits have been found of silver, gold, lead, uranium, vanadium, copper, guano, tungsten, molybdenum, antimony, salt, kayanite, selenium, tellurium, and asbestos. In most instances, the low



GENERALIZED

GEOLOGIC SECTION

AT GRAND CANYON VILLAGE

tenor of the ore bodies and their small extent, coupled with the lack of water and excessive difficulty of transportation, has prevented any significant amount of mineral production from Grand Canyon. The copper mines on Horseshoe Mesa produced for a number of years around the turn of the century, before the owners discovered the greater wealth to be had in transporting tourists instead of copper ore on their pack mules.

The only mine which has produced a significant amount of ore is the Little Orphan Lode Mine on the South Rim of the Grand Canyon, two miles west of Grand Canyon Village. The primary ore body consists of uranium and some copper mineralization in a pipe of very limited extent. The deed to the Little Orphan Mine was transferred to the National Park Service in 1962 and all rights and properties of the mine will become National Park Service property on November 19, 1987. The mine is not within a proposed wilderness unit. Could still be used as uranium mine

In western Grand Canyon, at mile 265.9 on the Colorado River from Lees Ferry, are two large steel towers on the north side of the canyon about 800 feet above the Colorado River. These towers are the remains of a cable car transportation system used to carry bat guano to the South Rim, where the guano was then shipped by road to market. Mining operation began late in the 1940's to early 1950's and continued until the middle 1950's, when the introduction of less expensive nitrate fertilizers made the mine an uneconomical venture.

No oilshale or coal-bearing strata are known to exist within Grand Canyon. Petroleum or natural gas have not been drilled for within the park. As the Colorado River has cut through to the basement of metamorphic rocks, it is assumed that any fluid resources that may have existed have long since followed the path of the ground water resource and drained from the strata adjacent to the canyon. Two wells have been drilled well back from the canyon on both the North and South Rims in an effort to find oil. Both wells were dry holes. There are no geothermal resources present in Grand Canyon.

The enlarged Grand Canyon National Park is not open to mineral entry. Lands added to the park from Lake Mead National Recreation Area are no longer subject to mineral leasing. The mineral reservations on the Sanup Plateau and Shivwits Plateau are based upon subsurface ownership rights and not upon actual mineral discovery and mineral claim.

D. SOILS

Erosion and weathering of the highly jointed Kaibab Limestone and remnant patches of Moenkopi siltstone along the rims of the canyon have produced thin, stony, poorly developed podzolic mountain soils which are low in

organic material. Rim soils are developed in place and are so immature that in only a few areas can the beginnings of soil profile development be seen. Rim soils in general have been placed in the Soldier-Jacks-Mirabal Association. Soils within the canyon resemble those on the rims in that soil profiles have not developed and most of the soil material is developed from the underlying bedrock. Alluvial deposits along the Colorado River and major tributaries combine with colluvial deposits to form the major transported soils of the Inner Canyon. Soils in the broad valleys of the Tuweep District are being developed on volcanic cinders and mixed alluvial sediments.

Comprehensive or detailed soil mapping has not been done throughout the park. Soils classification has either been extremely generalized or excessively technical in detail and limited in scope. A fire management study in the Point Sublime area indicates that Glossic Cryoboralf, Cumulic Cryoboroll and Lithic Ustollic Haplargid soils are present. Perhaps the best manner in which to view the soils of the park is to consider them as a shallow skin of dirt covering the bedrock.

The shallow soils and scattered vegetation provide for rapid infiltration of rain and snowmelt. Productivity of the soils is low and special soil studies will have to be done to insure success of restoration planting on water catchment and roadway areas being returned to a natural condition.

The large areas of bedrock, shallow soils and sparse vegetation create an ideal situation for sheet wash, flash flooding, and high erosion potential. Once disturbed, the soils erode easily and regenerate slowly. Sand beaches immediate to the river suffer greatly from the erosion forces of the Colorado River. Comparative photographs show that beaches are being rapidly eroded. The beaches are not being replenished due to the decreased sediment load of the river caused by the installation of Glen Canyon Dam. It is probable that in the near future many of the beaches will disappear from along the river.

E. WATER RESOURCES

1. Colorado River

Water is a vitally necessary natural resource, especially in the arid southwestern United States. Here, legal and institutional systems are organized to control the use of water. In the Grand Canyon region the use of water is subject to Federal law, the laws of individual states, interstate compacts, and agreements to apportion the waters of interstate streams. Water rights are generally based on beneficial use of the water and on the appropriation doctrine in which first-in-time is first-in-right. Most of the readily available surface water, and even most of that which can be developed only with difficulty, has been assigned to specific applicants or users. The remaining supply is

usually desired and actively pursued by numerous state and interstate groups, as well as private individuals.

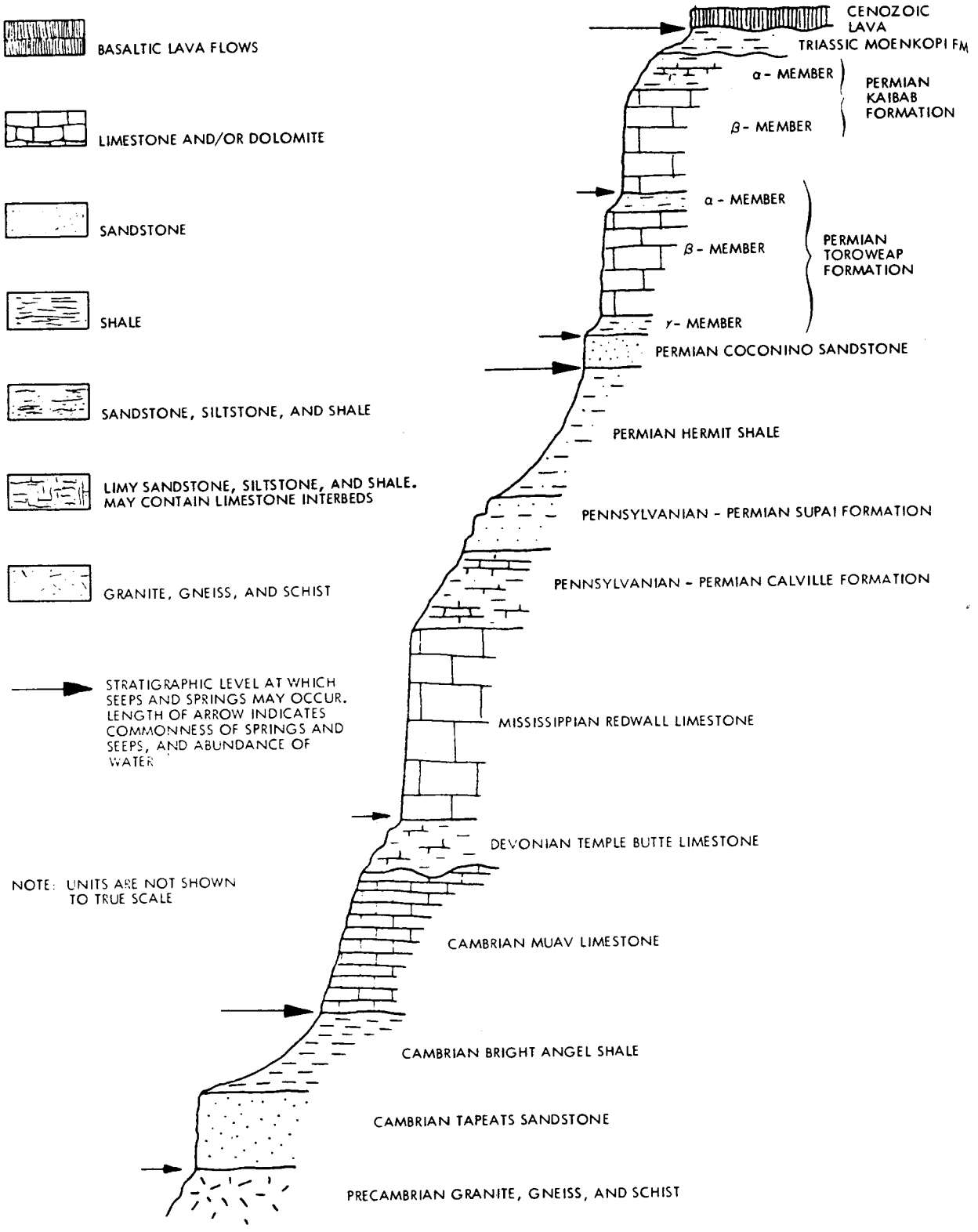
The Federal Government has asserted, and the courts have affirmed, that it has the right to sufficient water to develop Federal "reserved" land such as that reserved for national parks, provided that the water is used for the purposes of the reservation. The right is effective as of the date of the reservation action. The Federal Government thus has the use right to waters originating in, or flowing through, Grand Canyon National Park.

Most of the flow of the Colorado River through the Grand Canyon originates in the high mountain areas that rim the Upper Colorado Region. The estimated annual virgin runoff in the Colorado River at Lees Ferry, Arizona, at the head of Marble Canyon, has ranged from 5.6 to 24.0 million acre-feet. The 10-year means have ranged from 11.6 to 18.8 million acre-feet. Opinions thus differ concerning the period of record that best predicts future runoff. The significance is the fact that a period of about 25 years (1906-1930) of predominantly above-average runoff has been followed by a 40-year period (1931-1970) of predominantly below-average runoff.

In Article III, the Colorado River Compact requires that "the States of the Upper Division will not cause the flow of the river at Lees Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of ten consecutive years." Projected depletion requirements for the Upper Basin to the year 2020 have been made by the Pacific Southwest Inter-Agency Committee for the U.S. Water Resources Council.

These indicate that by that year the streamflow at Lees Ferry will be reduced by 6.5 million acre-feet. Current usage accounts for much of the nearly complete utilization of the Colorado River, when the mean virgin flow at Lees Ferry is near the level at which it has been for the last 40 years, with the balance of usage caused by the initial filling of Upper Basin reservoirs. Although the flow of the Colorado River through Grand Canyon is thus assured, the daily, seasonal and yearly flow will fluctuate greatly as reservoir and energy commitments are met.

Despite the tremendous quantity of water flowing through the mile-deep canyon, the history of water supply at Grand Canyon has been one of insufficiency. As the river cut a canyon through the rock units of the canyon, the ground water drained into the canyon. Collections of surface water are temporary and rare because of the ease with which precipitation penetrates into the substrata, and springs of any consequence are rare within the backcountry of the canyon. The following diagram indicates that the most common occurrence of springs and seeps is where canyons cut through strata containing perched waterbodies.



Diagrammatic stratigraphic section of the Grand Canyon region, showing lithologies and locations of main spring and seep lines.

2. Water Quality

High levels of dissolved mineral salts in the Colorado River are a major water quality problem in Arizona. The Colorado River enters Grand Canyon with a total dissolved solids concentration averaging 586 milligrams per liter. This amounts to 8.7 million tons per year. The water is primarily of the calcium-sodium-sulfate type.

Grand Canyon contains several springs which are high in total dissolved solids and thus contribute to the total load of the Colorado River. Water quality is also affected by large amounts of sediment entering from flooding tributary streams. The watershed areas drained by streams tributary to the Colorado River through Grand Canyon contribute from 0.5 to 1.0 acre-feet of sediment per square mile per year. Long-term records show an average annual sediment discharge of about 10 million tons into the Colorado from the Little Colorado River. Heavy loads of sediment occasionally are carried into the Colorado River at Lees Ferry by the Paria River. Recorded sediment concentrations in Kanab Creek at Fredonia, Arizona, north of the park, have reached 700,000 parts per million and concentrations of up to 500,000 parts per million may often be found in this stream during periods of intense rainfall and runoff.

Substantial amounts of oil and gasoline can be spilled into the Colorado River at Lees Ferry from boat servicing facilities. Ruptured gasoline tanks can also leak during motorized trips through the canyon. On the average, an estimated 20 to 35 percent of the fuel used in outboard motors is wasted in the exhaust. Laboratory studies of pollutants from outboard motor exhaust indicate that approximately 0.23 pounds of oil, as measured by nonvolatile suspended solids, are wasted per gallon of fuel consumed. The turbulence caused by the propeller creates conditions ideal for dispersion of the waste material into the water. The rest enters the air as an air pollutant in the canyon. No estimate is available for the total amount of fuel used within the Grand Canyon by motorized trips each year. However, the scale of the problem may be visualized by using the National Park Service patrol boat as an example. This boat uses approximately 50 gallons of fuel for a run from Lees Ferry to Diamond Creek, and makes the trip about 10 times a season. In one year's time, the boat thus will leave approximately 115 pounds of unconsumed oil and gasoline in its wake to be dispersed by the air and water in the canyon.

Preliminary chemical and bacteriological surveys have been made in the Grand Canyon section of the Colorado River to assess possible health hazards to river travelers and backcountry hikers. The water quality of the main Colorado River channel is relatively stable with only slight increases in ionic concentration and bacterial load with respect to distance from Lees Ferry. The bacteriological contamination in the main

river channel is normally at or below the standards set for drinking and recreational use set by the states of Arizona and Nevada and by the Federal Water Pollution Control Administration. This does not preclude the necessity of treating water taken from the main channel for drinking purposes but it does indicate that proper chlorination, boiling or other treatment will easily make the water safe for drinking.

Many of the side streams present quite another picture, at least with respect to recreational primary contact. The bacteriological contamination in most of the popular streams and swimming holes is in excess of the levels recommended for primary contact. The tributary streams show extreme temporal variability in chemical water quality and bacteriological contamination as a result of the summer rain and flood patterns. Bacteriological contamination of Havasu and Kanab Creeks may be the result of poor domestic waste treatment practices. Fredonia, Arizona and Kanab, Utah are the probable sources of fecal contamination load in Kanab Creek. The 2,500 inhabitants of Kanab use a single trickling filter unit for secondary treatment of fluid wastes. The 800 persons in Fredonia use septic tanks for the disposal of domestic wastes. Tremendous increases in bacteriological activity in the waters of Kanab Creek occur during flood periods, forming a health hazard to backcountry users who fail to treat the water properly before drinking it.

Water samples from Havasu Creek show evidence of human fecal contamination. The source of this contamination is the village of Supai on the Havasupai Indian Reservation. There is a significant increase in bacteriological activity in Havasu Creek as it passes through the village of Supai. Supai lacks waste treatment facilities and has a considerable population of domestic animals. The waters of all tributary streams must be considered to pose a potential health hazard to hikers and river travelers. Backcountry travelers are warned of this hazard and advised of proper water treatment methods.

At the present time, the Colorado River is the most seriously man-altered natural resource within the park. Since the closing of the gates on Glen Canyon Dam in 1963, the direct actions of human technology have abruptly and severely altered the character of the river ecosystem and that of its riparian zone.

The volume of water flowing through the Grand Canyon is significantly reduced. Since 1963 there has been a reduction of 82 percent in the average maximum flows and a 33 percent reduction in the average flow. The character of rapids, beaches, sandbars, and vegetation is strongly influenced by the volume and timing of water flow. A low dam has been proposed above Lees Ferry to store water for a more uniform rate of release.

The sediment load of the river is now about one-sixth of what it was prior to the dam. Sandbars and beaches depend upon sand replenishment from the main river and the heavy silt loads brought in from the Little Colorado River do little to maintain them. Less silt and shallower river depths allow for a greater penetration of light and a concomitant increase in the photosynthetic activity of both floating and attached algae.

Water temperatures in the river are significantly lower because the water released from Glen Canyon Dam comes from beneath the Lake Powell thermocline. The chemical content of the water in the river is slowly changing as a consequence of impoundment, evaporation, reduced flow, algae growth, and other factors. Bacteriological contamination of the water is also increasing.

The dynamics and composition of native flora and fauna populations are changing. Exotic plants and animals are becoming established and competing with native species. The native fishes which evolved in a muddier and warmer river are faced with a changing environment and increasing competition from introduced game and non-game fish.

A base level of information is being established through research so that adequate management directions may be taken on this complex and changing natural resource. Toward this end, a River Management Plan and environmental assessment of the plan and its alternatives have been set in motion. Ongoing research projects will be described in the Resource Investigations section of the Natural Resource Management Plan for Grand Canyon National Park.

3. Hydroelectric Potential

The Colorado River develops approximately 1940 feet of head between Glen Canyon Dam and the slackwater of Lake Mead. At least 25 sites have been surveyed within the 277 miles of Grand Canyon between Lees Ferry and the Grand Wash Cliffs for the possible construction of dams to utilize the fall of the river as a hydroelectric resource. These potential dam sites and their river mile distances below Lees Ferry are given in Table 2.

TABLE 2

POTENTIAL DAMSITES

Marble Gorge	4.5	Vaseys Paradise	32.2
Redwall, Upper	29.0	Marble Canyon	39.5
Redwall	30.0	Mineral Canyon	77.8

Clear Creek	84.4	Diamond Creek, upper	225.5
Granite Wall	85.1	Diamond Creek, lower	225.9
Cremation	86.3	Travertine Canyon	228.6
Pipe Creek	89.0	Bridge Canyon	236.3
Ruby Canyon	103.9	Hualapai	237.5
Hakatai	110.7	Spencer Canyon	246.2
Big Bend	113.3	Devils Slide	255.6
Specter Chasm	130.0	Flour Sack Rapids	266.0
Havasu	156.6	Pierces Ferry	277.3
Prospect Canyon	190.1		

The Marble Canyon and Hualapai sites have received serious consideration for dam construction and proposals to develop these sites have been made by various individuals and organizations.

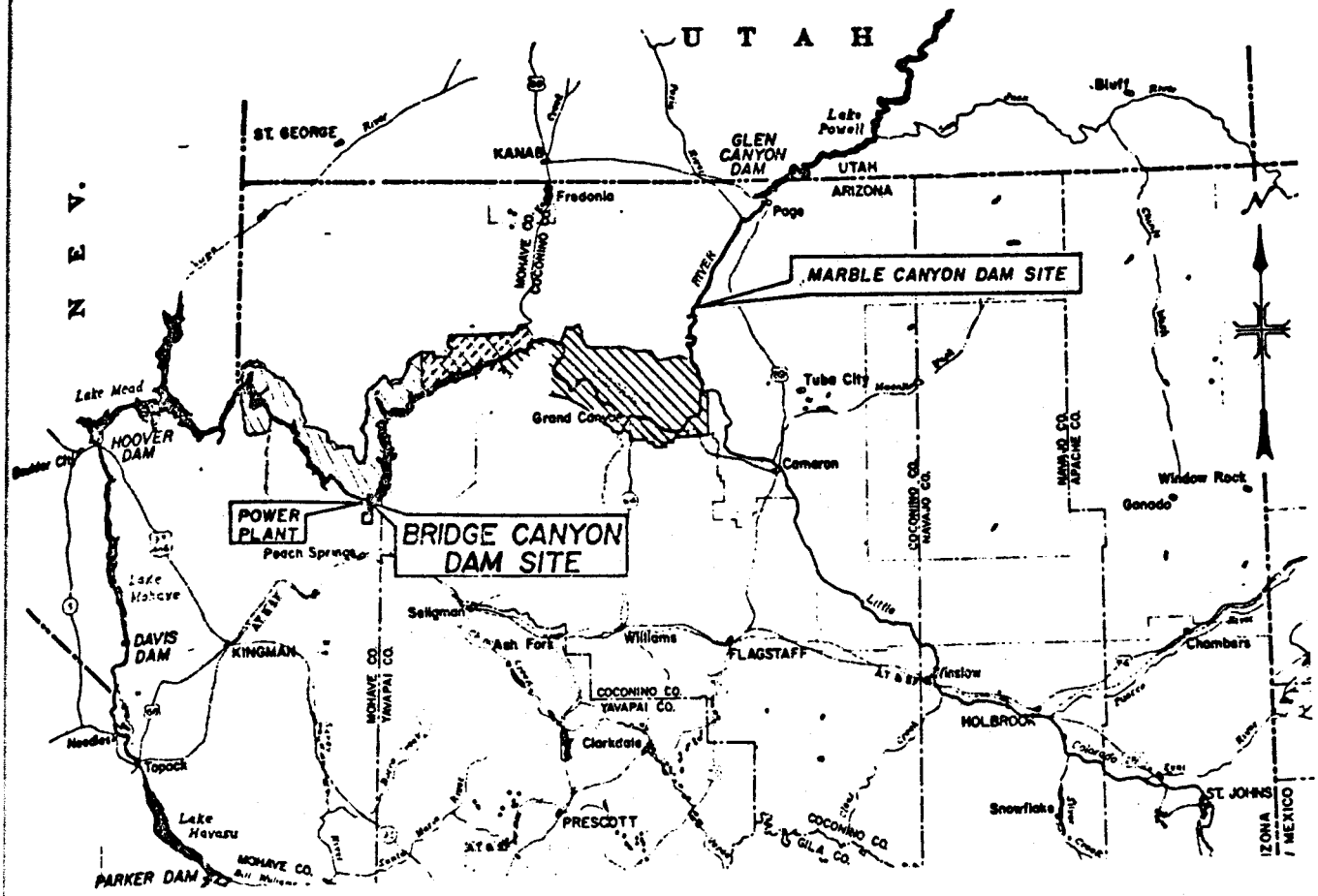
Applications were filed with the Federal Power Commission by the Arizona Power Authority and the City of Los Angeles for licenses to develop the Marble Canyon and Hualapai sites. Subsequently, the Colorado River Basin Project Act, Public Law 90-537, enacted in 1968, withdrew the Commission's licensing authority for the reaches of the main stream of the Colorado River between Hoover Dam and Glen Canyon Dam. The Act also specifically prohibits the study or the construction of any dams on that section of the Colorado River. The Grand Canyon Enlargement Act retains this prohibition.

Due to the energy crisis currently being experienced in this country, there have been recent political moves to change the laws prohibiting construction of these dams. Permission to construct the Hualapai low dam is particularly being sought. In 1968 the Hualapai project was dropped as a funding source for the Central Arizona Project with the agreement of the Arizona Congressional delegation. In 1974, the House Committee on Interior and Insular Affairs of the United States Congress defeated amendments to the Grand Canyon National Park Enlargement Act which would have allowed for the construction of the Hualapai Dam.

F. CLIMATE

The Grand Canyon has many climates, determined mainly by differences in elevation and exposure. Average annual precipitation varies from more than 25 inches along the forested North Rim (8,200 feet) to less than 9 inches on the desert environment of the Inner Canyon (2,400 feet). Intermediate amounts of 16, 13, and 12 inches of precipitation fall each year at Grand Canyon Village, Desert View and Tuweep, respectively.

The North Rim receives more precipitation in winter than in summer; the South Rim and the Inner Canyon receive about equal amounts during the two seasons. The spring and fall are relatively dry in all three areas.



PROPOSED HYDROELECTRIC PROJECT SITES
GRAND CANYON NATIONAL PARK

Summer precipitation usually falls from thunderstorms that form over the heated canyon walls almost every afternoon from early July until the end of August. Although these storms are capable of producing locally heavy downpours, they rarely last more than 30 minutes and usually cease completely shortly after sundown.

Winter precipitation is not as consistent as that of summer, varying greatly from year to year in both amount and frequency of occurrence. It is associated with middle latitude storms moving eastward from the Pacific Ocean and normally falls in gentle to moderate showers which may persist for several days. When these storms intensify over the California coast, move directly into northern Arizona from the west, and meet a cold wave sweeping down from the northwest, severe storms with heavy snow and strong winds can strike the areas. Practically all of the winter precipitation on the North and South Rims occurs as snow. An annual average accumulation of more than 130 inches on the Kaibab Plateau makes snowplowing expensive, and in the past has kept the road to the North Rim closed from November until mid-May. Snowfall averages 60 inches on the South Rim, but is a rarity in the Inner Canyon, where it averages less than one inch per year. Normal annual precipitation patterns for Arizona and the Grand Canyon region are shown on page II-16.

As can be seen from the temperature data which follows, the temperature will increase as one descends into the canyon. However, during the winter months there are short periods of temperature inversion when clouds fill the canyon and cold air drains into and is trapped within the canyon while the rims are being warmed by direct sunshine. Based on an elevation gradient of 4,800 feet and dry adiabatic lapse rate of 5.4°F/1,000 feet, the average adiabatic temperature change between the rim and the river is approximately 26°F. The air in the canyon is considered to be conditionally stable in August and September; statically unstable in June and July; and statically stable for the rest of the year. The hourly temperature at the rim and the river approach each other to within a few degrees in the hour just preceding sunrise.

Summer thunderstorms are frequent, heavy, and often violent. Lightning discharges are frequent during these storms and are extremely dangerous along the rims, on promontories, and on high points such as ridges within the canyon. Flash floods rise quickly from these storms and rush to the Colorado River, often destroying everything in their path. The steep side-slopes of tributary canyons can trap unwary hikers or campers in formerly dry creek bottoms with no hope of escape from these floods. The debris from the heaviest of these floods can change the configuration of rapids in the Colorado River, and at low river flow could cause natural damming for short periods of time. Heavy silt loads in the Colorado River from flooding on tributary streams combine with strong river currents to make the river dangerous for swimmers or individuals attempting to make crossings via air mattresses.

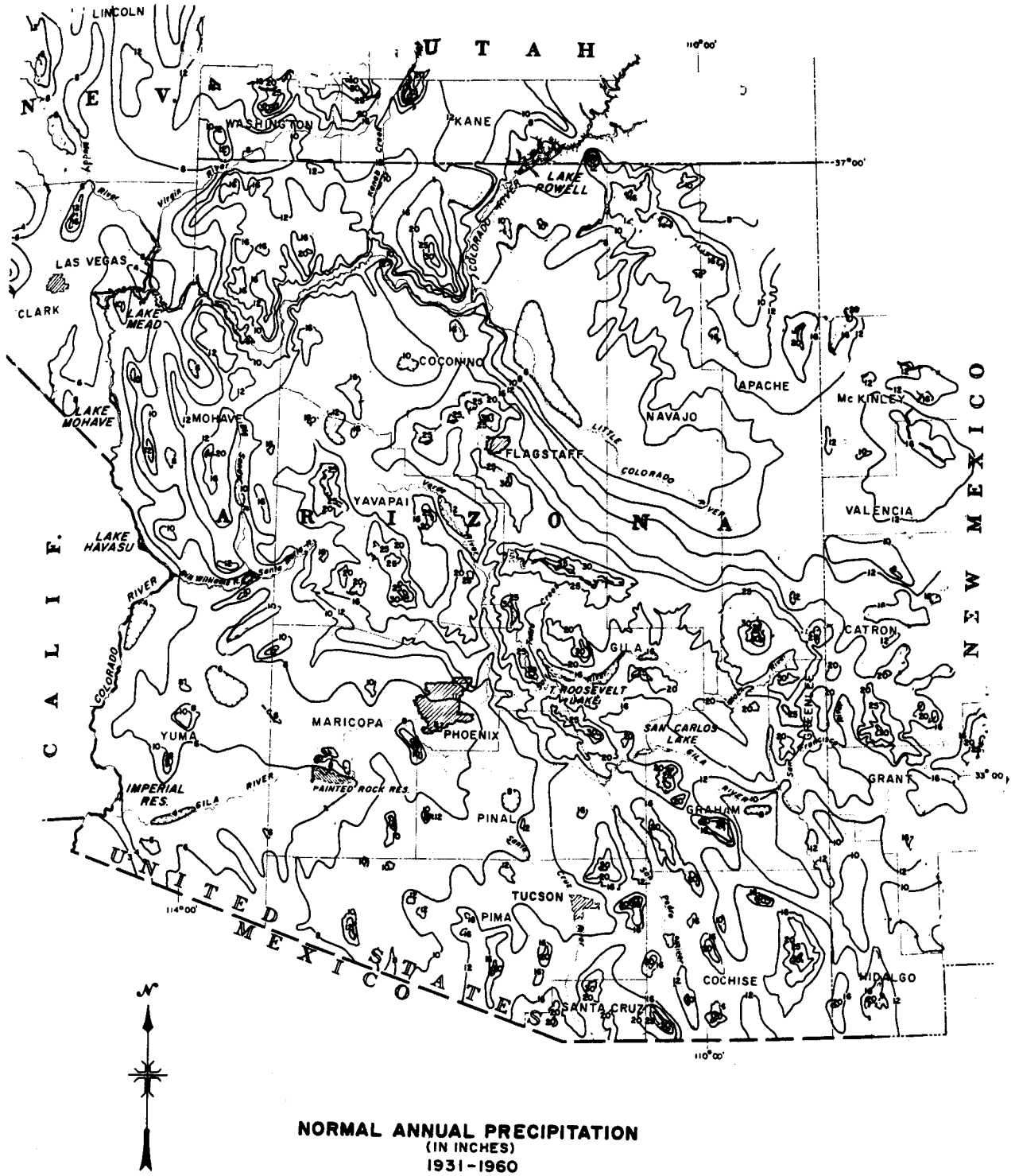

LINCOLN
UTAH
NEVADA
WASHINGTON
KANE
LAKE POWELL
LAS VEGAS
CLARK
LAKE MEAD
COCONINO
APACHE
McKINLEY
LAKE MOHAVE
MOHAVE
NAVAJO
FLAGSTAFF
YAVAPAI
VALENCIA
LAKE HAVASU
CALIF.
ARIZONA
NEW MEXICO
COLORADO RIVER
GILA
CATRON
T. ROOSEVELT LAKE
MARICOPA
PHOENIX
SAN CARLOS LAKE
YUMA
IMPERIAL RES.
PAINTED ROCK RES.
GRANT
GRAHAM
PINAL
TUCSON
PIMA
COCHISE
SANTA CRUZ
HIDALGO
UNITED STATES OF MEXICO
114°00'
110°00'
37°00'
33°00'
N
NORMAL ANNUAL PRECIPITATION
(IN INCHES)
1931-1960
30 0 30 60 90
SCALE OF MILES

TABLE 3

MEAN PRECIPITATION AND TEMPERATURE

GRAND CANYON NATIONAL PARK

MONTHS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MEAN MAXIMUM TEMPERATURES (^{o}F)												
Inner Canyon	56	62	71	82	92	101	106	103	97	84	68	57
Tuweep	49	50	61	68	79	89	95	92	85	74	61	49
Desert View	40	43	49	57	69	79	84	81	73	61	49	39
South Rim	41	45	51	60	70	81	84	82	76	65	52	43
North Rim	37	39	44	52	62	73	77	75	69	58	45	40
MEAN MONTHLY TEMPERATURES (^{o}F)												
Inner Canyon	46	52	59	69	77	86	92	89	83	72	57	47
Tuweep	38	40	47	54	64	73	80	78	71	60	48	39
Desert View	30	33	38	44	56	65	71	69	61	50	39	30
South Rim	30	33	38	46	54	64	69	67	61	50	39	31
North Rim	26	28	34	40	48	56	62	60	54	45	35	30
MEAN MINIMUM TEMPERATURES (^{o}F)												
Inner Canyon	36	42	48	56	63	72	78	75	69	58	46	37
Tuweep	26	30	34	40	49	58	65	63	56	46	35	29
Desert View	21	23	27	31	42	51	59	56	59	39	30	21
South Rim	18	21	25	32	39	47	54	53	47	36	27	20
North Rim	15	18	24	28	34	40	46	45	39	31	24	20
MEAN PRECIPITATION (Inches)												
Inner Canyon	.72	.73	.79	.48	.31	.28	.79	1.31	.88	.69	.51	.82
Tuweep	1.10	.90	1.25	.73	.40	.40	1.28	1.97	.79	.80	.77	1.31
Desert View	1.00	.94	1.52	.75	.50	.32	1.29	1.34	.99	1.39	.80	1.72
South Rim	1.32	1.53	1.37	.92	.65	.46	1.87	2.28	1.50	1.21	.95	1.61
North Rim	3.28	3.17	3.12	1.67	.97	.76	1.86	2.53	1.81	1.50	1.44	2.62

G. AIR QUALITY

Natural dust particles, water vapor, chemicals given off by growing plants, and the refraction of light all combine to form a haze which is a natural part of the Grand Canyon environment. The predominant wind direction in the Grand Canyon area above the rims is from the southwest. Below the rims of the canyon there is little large-scale horizontal air movement. The deep, narrow configuration of the canyon forms a relatively closed air system of over 5,000 vertical feet.

In 1880, Clarence Dutton described the natural haze within the confines of the canyon thusly, "The very air is then visible. We see it, palpably, as a tenuous fluid, and the rocks beyond it do not appear blue, as they do in other regions, but reveal themselves clothed in colors of their own. The Grand Canyon is ever full of this haze. It fills it to the brim. We are really looking through miles of atmosphere under the impression that they are only so many furlongs. This apparent concentration of haze, however, greatly intensifies all the beautiful or mysterious optical defects which are dependent upon the intervention of the atmosphere."

For several years the visibility within the canyon was constantly monitored by a laser beam which was directed from the Yavapai Museum on the South Rim to a mirror at Phantom Ranch at river level. By measuring the amount of light scatter of the returning beam of light, a measure of air contaminants was obtained. This experiment was performed by Dr. R. G. Layton of the Physics Department at Northern Arizona University. Subjective visibility observations are currently being made from Desert View, using Navajo Mountain as a sighting target.

Surveys have been made to measure the aerosol-sized particles in the air. These are much smaller particles than windborne dust and the measurements are independent of the amount of dust in the air. In 1970, measurements made on backcountry trails indicated that aerosol particles measured from 300 to 940 parts per cubic centimeter. This compares quite favorably with some of the cleanest air on Earth (over the Pacific Ocean), where aerosol counts commonly range from 100 to 200 parts per cubic centimeter. When measurements were made on those trails which start near Grand Canyon Village (the area of highest automobile and human use) the count rose to 1,100 to 2,200 parts per cubic centimeter. When there are strong up-canyon winds along the Colorado River, the small particle count rises to about 2,400 parts per cubic centimeter. These winds would be coming from the Henderson-Las Vegas area, where there are both automobiles and coal-fueled power plants. An analysis of particulate matter in the air at Phantom Ranch made by the University of Utah indicated only a tiny amount of fly ash which would be an indicator

of air pollution from power plants. Thus, at this time the major air pollution problem at the Grand Canyon is the automobile. The aerosol analyses were performed by Dr. Eric Walther of the Colorado Plateau Environment Advisory Council.

The National Park Service operates an air quality sampling station just north of the visitor center in Grand Canyon Village. The 24-hour air samples, which have been taken periodically since 1970, are analyzed by the State of Arizona for particulate matter, sulphur dioxide, nitrogen oxides and heavy metals. Sulfation plates have been exposed within the park in a cooperative program with the Forest Service. Available information indicates that dustfall and sulfation rates, as well as the levels of sulphur dioxide, nitrogen oxides, lead, benzene organics, and total oxidants are all low to very low. When compared with national standards of air quality set by the EPA, the data indicate that the air quality of the canyon is excellent (see page II-20).

Because of its almost pristine purity, the air in Grand Canyon can be degraded by introducing pollutant levels which would be considered negligible in metropolitan areas. Visible ranges often exceed 190 kilometers (118 miles) in the exceptionally clean atmosphere above the canyon. Very small increases in atmospheric pollutants can significantly decrease visibility through air of this clarity and thus degrade the aesthetic values of the park.

The air movements are primarily up and down canyon at very low velocities, making the potential for removal of air pollutants very low. Most of the higher wind velocities encountered in the canyon are not due to the exchange of canyon air with air above the rims, but rather a sloshing of a limited volume of local air back and forth within the canyon. The slow circulation of air and low dispersive capabilities increase toward the level of the Colorado River. Inversion layers or stable environmental lapse rates develop each night within the canyon and increase the stagnation of air circulation.

Pursuant to the Clean Air Act, as amended in 1970, the Environmental Protection Agency developed regulations to prevent significant deterioration of air quality in the United States. Three airshed classes were established in which different incremental increases were allowed in total suspended particulates (TSP) and sulfur dioxide (SO_2) (see Table 5). Class I are areas where nearly any change in air quality would be significant; Class II applies to areas where the deterioration which normally accompanies moderate and well-controlled growth would be considered insignificant; and Class III applies to areas in which air quality deterioration up to the national standards would be considered insignificant. As a starting point, all areas in the country were designated as Class II with provisions for future reclassification of an area to

TABLE 4 -- AIR QUALITY DATA AVAILABLE
GRAND CANYON VILLAGE AND VICINITY
1969 -- 1972

TABLE 4 -- AIR QUALITY DATA AVAILABLE
GRAND CANYON VILLAGE AND VICINITY
1969 -- 1972

Pollutant	Grand Canyon EPA Mean	Annual Phoenix Mean	Grand Canyon Walther's Data	EPA Standard-1[1]	EPA Standard-2[2]	Arizona Standard
Total particulates (aerosol) ug/m^3	34 (n = 56)	108-265	18	75[3]	60[3]	60[3]
Dustfall ug/cm^2/day	-	11.5	5.3	-	-	-
Sulphur Dioxide ug/m^3	10	cal0	cal0	80[4]	-	50[4]
Sulfation rate ug/cm^2/day	-	1.75	0.38	-	-	-
Nitrogen Dioxide ug/m^3	21 (n =58)	168	22	100[4]	100[4]	100[4]
Total oxidants ug/m^3	-	17.5	10.4	160[5]	160[5]	80[5]
*Lead ug/m^3	0.15	3.12	-	-	-	-
Benzene soluble organics ug/m^3	1.0	-	-	-	-	-
Benzopyrene ug/m^3	0.11	-	-	-	-	-

*1969 data. n = number of data points
1. Level of pollutant which, if exceeded, endangers "public health"
2. Level of pollutant which, if exceeded, endangers "public welfare"
3. Annual geometric mean
4. Annual arithmetic mean
5. Maximum 1-hour concentration

accommodate the social, economic, and environmental needs and desires of the public. Class I was established to give added protection to areas of unique scenic values - such as those of the National Park System.

TABLE 5

ENVIRONMENTAL PROTECTION AGENCY AREA
DESIGNATION AND DETERIORATION INCREMENTS

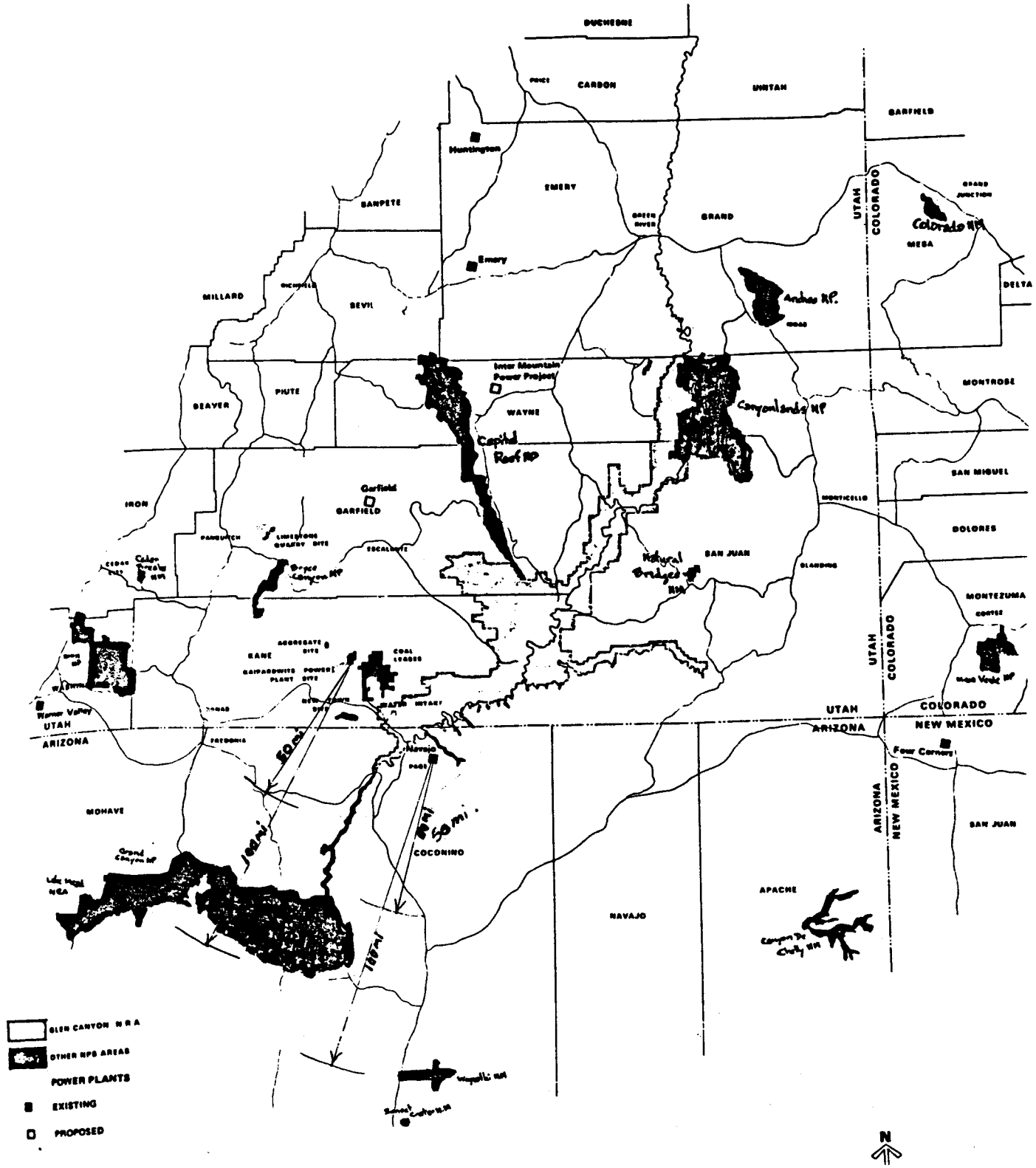
Pollutant	Class I (ug/m^3)	Class II (ug/m^3)
PARTICULATE MATTER (TSP)		
Annual Geometric Mean	5	10
24-Hour Maximum	10	30
SULFUR DIOXIDE (SO_2)		
Annual Geometric Mean	2	15
24-Hour Maximum	5	100
3-Hour Maximum	25	700

The major portions of Grand Canyon seen by park visitors and the major portions of the park being proposed for wilderness are well within 160 km (100 miles) of the proposed* 3000 megawatt Kaiparowits coal-fired power plant in Utah and within 120 km (75 miles) of the established coal-fired Navajo power plant at Page, Arizona (see map, page II-22). Collectively or individually these plants can cause changes in air quality which would be significant and preclude Class I designation for Grand Canyon. Table 6 is drawn from "Analysis of Kaiparowits Powerplant Impacts on National Recreation Resources" completed by the National Park Service in March 1976, and indicates the projected effect of this power plant on the eastern portions of the park. Unit 1 of the Navajo plant went on line in May 1974, Unit 2 in April 1975 and Unit 3 in April 1976. The view of Navajo Mountain from Desert View in the park has been obscured on a number of days in late 1975 and early 1976 by a brown haze.

H. NOISE LEVELS

One of the many environmental stresses that man seeks to escape by visiting Grand Canyon is the clamor of our technological society. To a great degree, he can do this if he travels into the outback of the canyon's wilderness. But all of the park is not wilderness and the vast majority of park visitors do not pass beyond the developed areas or the corridor trails where the problem of noise pollution is at its highest.

*In the spring of 1976 the utility consortium backing this plant withdrew its support from this proposal and its development is not definite at this time.



LOCATION OF PROPOSED KAIPAROWITS POWER PLANT

TABLE 6

SOUTHERN UTAH PARKS AIR QUALITY STUDY
10 MINUTE AND 24 HOUR CONCENTRATIONS FOR SELECTED POINTS
USING NOAA MODEL

Point No.	Location	Distance (km)	SO_2 (ug/m^3) E Stability				NO_2 (ug/m^3) E Stability			
			10 minute		24 hour		10 minute		24 hour	
			2m/s wind	3m/s wind	2m/s wind	3m/s wind	2m/s wind	3m/s wind	2m/s wind	3m/s wind
	PROPOSED FOUR-MILE BENCH SITE									
1.	Bryce Canyon National Park	50	143*		19*		564		75	
2.	Bryce Canyon National Park	60	127*		17*		501		67	
3.	Bryce Canyon National Park	50		102*		13*		403		67
4.	Bryce Canyon National Park	60		85*		11*		335		43
5.	Glen Canyon NRA - Navajo Point	59	130*		17*		512		67	
6.	Glen Canyon NRA - Navajo Point	59		86*		11*		342		45
7.	Glen Canyon NRA - Spencer Point	51	153*		20*		604		79	
8.	Glen Canyon NRA - Spencer Point	51		106*		14*		418		55
9.	Capitol Reef NP - Wagon Box Mesa	74	-		12*		360			
10.	Capitol Reef NP	74		62*		8*		247		32
11.	Bryce Canyon NP	52	155*		21*		611		82	
12.	—— Grand Canyon NP - Imperial Point	120		45*		6*		128		23
13.	SW Base of Canaan Peak	30	333*		44*		1309		177	
14.	SW Base of Canaan Peak	30		222*		29*		857		112
15.	SE Base of Tablecliff Mesa	45	223*		29*		880		115	
16.	SE Base of Tablecliff Mesa	40		149*		20*		583		76
	PROPOSED NIPPLE BENCH SITE									
Point No.	Location									
1.	Bryce Canyon - Rainbow Point	65	114*		15*		448		59	
2.	Bryce Canyon - Rainbow Point	65		75*		10*		267		35
3.	Glen Canyon NRA - Spencer Point	45	189*		25*		747		98	
4.	Glen Canyon NRA - Spencer Point	45		126*		16*		497		65
5.	Glen Canyon NRA - Navajo Point	64	164*		21*		645		84	
6.	Glen Canyon NRA - Navajo Point	64		122*		16*		305		40
7.	—— Grand Canyon NP - Imperial Point	102	63*		8*		249		32	
8.	—— Grand Canyon NP - Imperial Point	102		41*		5		162		20
9.	Near Cockscomb	30	259*		34*		1023		134	
10.	Paria Plateau	30	443*		58*		1745		228	

*Note: Denotes violation of Class I concentration increment.

Noise pollution is insidious, in that we suffer less from noises that we accept, and thus, noise levels creep upward unnoticed. If Grand Canyon Village, for instance, is as noisy as the metropolis that the visitor has just left, then it is doubtful whether the visitor will notice any noise pollution. Grand Canyon Village is not a quiet place, and there are periods when one cannot escape from the noise of man and his machines even by being deep within the wilderness of the canyon. The shattering of a wilderness experience by the sounds of our technical society is highly disproportionate to their measurable intensity.

Noise is undesired sound, and does not actually exist apart from the experience of a receiver whose central nervous system reacts to a particular adverse sound. Subjective considerations make the quantification of annoyance difficult. The correlation of any noise index with the human responses elicited in a wide group is inherently poor because of the wide variation of individual responses to the same stimulus. Better correlations can be obtained only by taking into account the social and psychological parameters responsible for these variations. Sound levels measured on the dBA scale correlate with human responses as well as any of the noise ratings.

In setting desired sound levels for any area within Grand Canyon National Park, the characteristics of the users and the type of use must be taken into consideration. The intrusion of any sound is largely based on the connotation of that sound, and not on its level or duration. Thus, one approach to establishing a desired sound level in wilderness areas of the park would be to insist that man-made sounds be completely muffled or submerged in the background noise. This means that the sound from such sources as aircraft flights over the canyon must be reduced to about 15 dBA below the prevailing background noise at ground level. A criterion of about 20 to 25 dBA seems to be indicated. If it is accepted that the complete loss of sound is too restrictive in backcountry areas, then another possible basis for noise criterion is one related to a situation that is familiar and acceptable to many people. The continuous rumble of traffic noise at distances greater than a mile or two from any reasonably busy road is approximately 45 dBA. This number is commonly accepted as a reasonable noise level for sleeping areas in the suburbs of cities. If 45 dBA were set as a criterion for backcountry and proposed wilderness areas of the park, a large percentage of users would find intrusions of this magnitude odious. It would seem that the most sensible criterion would be to select a rating between 25 and 40 dBA.

Outdoor sounds are usually attenuated or reduced in intensity before reaching the listener. Spherical divergence or normal attenuation is due to distance. Each time the distance from the source is doubled, there is a reduction in the sound of approximately 6 dBA. Excess attenuation is the introduction of sound barriers between the sound source

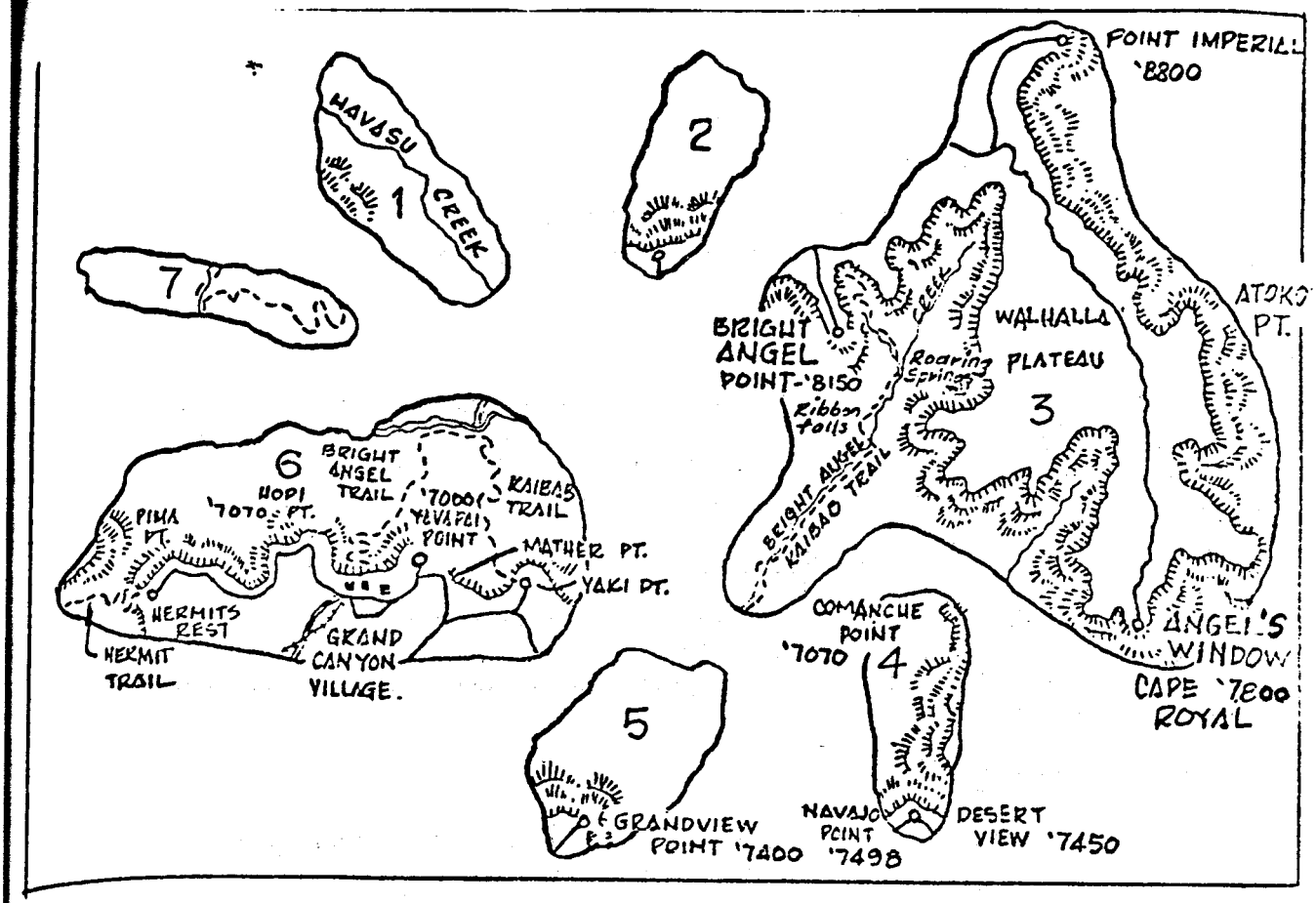
and the listener. The excess attenuation provided by forest and other vegetative cover is negligible under most conditions found at Grand Canyon, as dense stands of conifers with a heavy understory of brush would only reduce noise levels by less than 10 dBA per 100 feet. Thus, distancing is the most effective method of reducing sound intensity.

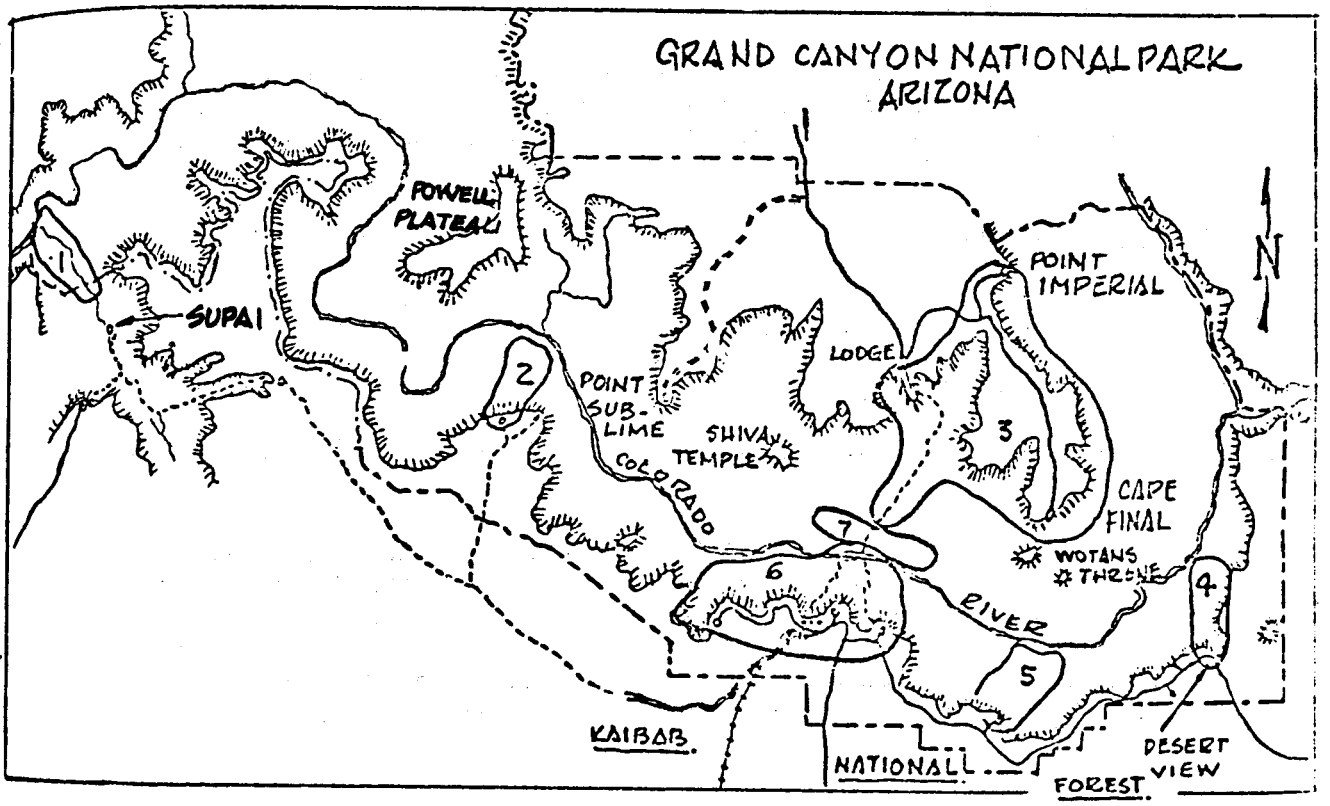
A preliminary sound survey was made on Labor Day in 1971 by Dr. Black of Northern Arizona University. He reported that the drone of aircraft engines could be heard almost continuously on that day of survey. The aircraft are a mixture of fixed-wing and helicopter tour planes, private planes, military aircraft, and high altitude commercial craft. Automobile noises were the most pervasive at overlooks and within Grand Canyon Village.

Black found that in general the ambient noise levels ranged from about 45-50 decibels in remote backcountry areas to around 70 decibels in late afternoon on the front steps of the El Tovar Hotel. At most sampling stations it was found that noise from automobiles, aircraft, buses, and motorcycles elevated the ambient levels as much as 25-30 decibels, while nearby human conversations would raise the levels by 5-15 decibels. While measuring sound levels in front of the superintendent's residence, Black found eight occasions during a single 15-minute period when the motor vehicle noise raised sound levels above 85 decibels. Prolonged exposure to noise levels of 80 decibels will result in hearing loss.

While the sounds from motor vehicles and aircraft are the most disruptive along roadways, at overlooks and in the developed areas of the park, the sounds from aircraft and outboard motors are the most disruptive in proposed wilderness areas. The noise problem associated with the use of outboard motors on raft trips through the Grand Canyon was studied in the summer of 1973 by Drs. D. N. Thompson, A. J. Rogers, Jr., and F. Y. Borden of the University of Pennsylvania. They found that sound-pressure and levels of the motors, measured at head level in the boatman's station, ranged from 83 to 89 dBA, compared with background levels of 35 to 45 dBA. This borders on, but does not clearly exceed, present health standards, although it can cause significant shifts in the hearing threshold. In the presence of motor noise, natural environmental sounds or the almost unnatural lack of sound in the canyon can never be sensed by party members. The study concluded that outboard motor noise was a deterrent to normal, relaxed conversations that one should expect in such an environment, a safety hazard in raft operation, and a potential health hazard to the boatman.

In an effort to reduce the disturbance to the natural environment caused by aircraft noise, the Federal Aviation Administration, Grand Canyon National Park, and aircraft operators at the Grand Canyon have entered into an agreement whereby scenic flights over certain areas of the park are to be conducted as follows (see map on page II-26):


HAVASU CREEK
1
2
7
6
BRIGHT ANGEL TRAIL
HOPI PT.
7070
YAVAPAI POINT
KAIBAB TRAIL
PIMA PT.
MATHER PT.
YAKI PT.
HERMITS REST
HERMIT TRAIL
GRAND CANYON VILLAGE.
POINT IMPERIAL 8800
ATOKA PT.
BRIGHT ANGEL POINT-8150
WALHALLA PLATEAU
Roaring Springs Creek
Ribbon Falls
BRIGHT ANGEL TRAIL
KAIBAB TRAIL
3
COMANCHE POINT 7070
4
ANGEL'S WINDOW
CAPE ROYAL 7800
5
GRANDVIEW POINT 7400
NAVAJO POINT 7498
DESERT VIEW 7450


GRAND CANYON NATIONAL PARK
ARIZONA
POWELL PLATEAU
SUPAI
2
POINT SUBLIME
SHIVA TEMPLE
COLORADO
LODGE
POINT IMPERIAL
N
3
CAPE FINAL
WOTANS THRONE
1
6
RIVER
4
5
KAIBAB
NATIONAL
FOREST
DESERT VIEW

Area 1 - Havasu Creek

All aircraft, fixed wing and helicopters, shall not operate at an altitude below 5,000' MSL over this area. Helicopters landing or taking off from the Havasupai Reservation are exempted from this requirement.

Area 2 - Bass Trail

No flights shall be conducted by either fixed-wing aircraft or helicopters within this area. When necessary to overfly the area, aircraft shall not operate below an altitude of 6,500' MSL within the confines of the Canyon and not below an altitude of 8,500' MSL while over the Rim.

Area 3 - North Rim, Cape Royal, and North Kaibab Trail

No flights shall be conducted within this area by either fixed-wing aircraft or helicopters. When circumstances do not permit avoiding these areas, aircraft shall not operate over them below an altitude of 10,000' MSL.

Area 4 - Desert View

Helicopters and fixed-wing aircraft shall not operate over this area below an altitude of 8,500' MSL.

Area 5 - Grandview

Fixed-wing aircraft shall not operate below an altitude of 8,500' MSL within this area. Helicopters shall operate at an altitude not below 8,500' MSL when flying over the Rim areas and not below 5,000' MSL when flying within the Canyon.

Area 6 - South Rim

Helicopters and fixed-wing aircraft shall not operate over this area below an altitude of 8,500' MSL.

Area 7 - Phantom Corridor

Helicopters and fixed-wing aircraft shall not operate over this area below 6,000' MSL.

It can easily be seen that, with the exception of the Bass Trail area, one of the effects of this agreement is to protect the developed area user from unwanted sound at the expense of the backcountry user.

The viewing of the Grand Canyon and the Grand Canyon "experience" should be within the context of a certain modicum of quiet contemplation. The

widespread mystique which says that a mechanical device is not efficient unless it is noisy is being countered by environmentally oriented interpretive programs within the park.

I. BIOTA

More than a thousand species of plants are found within the park. Large native animals such as mule deer, bighorn sheep, mountain lion, bobcat, and coyote seek their livelihood within the Grand Canyon and surrounding plateaus. Seventy-five to eighty species of mammals, 230 varieties of birds, and 40 species of amphibians and reptiles have been recorded from Grand Canyon National Park. Animal species are given in Appendix B, C, and D.

Sixteen species of fish have been recorded from the Colorado River and its tributaries with Grand Canyon. However, the available data indicate that the main channel of Marble and Grand Canyons is unfavorable fish habitat. The volume and swiftness of the river, plus the shortened period of sunlight due to the high walls, in conjunction with the cold water being discharged from Glen Canyon Dam, keep the river cold throughout most of the canyon. No major tributaries effectively ameliorate the low temperature of the waters, and spawning temperatures for the native fishes are not met. Daily changes in river level preclude the number of aquatic life forms that would normally make up a food base for the fish. To an aquatic biologist, the river through Grand Canyon is a very sterile environment. The rare humpback chub, the loach minnow, and the Colorado River squawfish are not reproducing successfully and will disappear from the river within the park as the present adult population dies. It is very likely that only those native species, such as speckled dace, bluehead, and flannelmouth sucker, which are adapted to tributary streams, will survive.

The Colorado River squawfish, Ptychocheilus lucius, and the humpback chub, Gila cypha, are threatened with extinction. Both fish are protected under the Code of Federal Regulations, Title 50. The squawfish is extinct in Wyoming because of habitat destruction caused by Flaming Gorge Dam on the Green River. The fate of this fish downstream from Glen Canyon Dam is unquantified at this time, but there has been a severe population decline within the last decade. There are very few documented records of the humpback chub occurring within Grand Canyon in the last 10 years and its occurrence must be considered extremely unusual.

The Little Colorado spindace, Lepidomeda vittata, is also threatened with extinction, with very few being reported in the past decade, and its occurrence in the mainstem Colorado River is extremely unusual. The status of the razorback or humpback sucker, Xyranchen texanus, has not been determined, but its occurrence in Grand Canyon is considered to be extremely unusual and there have been very few documented records of this fish in the past decade.

Carp and various chubs, shiners, minnows, and bullheads have been introduced and occur in the Colorado River and its lower tributaries in various quantities. Rainbow, brook, brown, black spotted, and Loch Leven trout have been introduced into Bright Angel, Clear, Shinumo, Garden and Tapeats Creeks. Plantings have been made as recently as 1967 in cooperation with the Arizona Game and Fish Department. No fish planting has been made within the park since that date; however, fish planting continues in the tailwaters of Glen Canyon Dam at Lees Ferry and at Diamond Creek. Fish from these plantings enter the park, competing with native fish populations for food and in many instances feeding off the young and eggs of the native fishes.

The variety of physical habitats within the Grand Canyon, interacting with the plants and animals that have come to live in them, has produced definite and characteristic assemblages of plants and animals called biotic communities. Each of these communities, with its distinctive floral and faunal makeup, gives diversity and life to the landscape and illustrates variations in lifeforms in response to differing physical environments. These communities are best defined and delimited by their plant species, as many of the animals can occupy more than one plant association. The biotic communities are thus not exclusive and many of the plants and animals that characterize a community merely reach their greatest abundance there.

Many physical factors are involved in delimiting such biotic communities: temperature, precipitation, slope exposure, rock and soil types, elevation, and humidity are just a few. Although all of the plant communities except for the spruce-fir and mountain grassland are duplicated north and south of the Colorado River, there is much isolation caused by the river and the Inner Canyon.

The riparian green belt of the canyon bottom forms an ecological complex that is delicately balanced against the harsh and variable desert climate. The presence of permanent water allows a denser community of both plant and animal life. Because of the cold water and the depth of the canyon, a moderate micro-climate exists. This allows animals and plants to live out of their normal life zones. Desert species are found living with those of high plateaus. Many forms of wildlife have adapted to live in the restricted canyon. The resident animals and birds live in a web of interdependence with their environment.

The riparian community along the Colorado River and its major tributaries is characterized by such plants as cottonwood, willow, desert willow and the exotic tamarisk. Some of the mammals which can be expected with the riparian community and in the desert scrub community of the Inner Canyon are the spotted skunk, ringtail, rock pocket mouse, long-tailed pocket mouse, raccoon, beaver, Yuma myotis and perhaps even the rare river otter. The feral burro has also established itself in this community.

TABLE 7

BIOLOGICALLY SENSITIVE AREAS ALONG THE COLORADO RIVER
GRAND CANYON NATIONAL PARK

Name	River Mile	Side of River
	17.5	south
Stantons Cave	31.8	north
Vaseys Paradise	31.9	north
Buck Farm Canyon	40.8	north
Spring Canyon	41.2	north
43-Mile	43.2	south
Saddle Canyon	47.5	north
Nankoweap	52.0-53.0	north
Kwagunt Canyon	56.0	north
Little Colorado River	61.5	south
Hopi Salt	62-64	south
Furnace Flats	65.6	south
Cardenas Creek	71	south
Red Canyon	76.6	south
Clear Creek	84	north
Phantom Ranch	87.5	north
Garden Creek	89	south
Monument Creek	93.5	south
Hermit Creek	95	south
Boucher Creek	96.5	south
Shinumo Creek	108.8	north
Elves Chasm-Royal Arch Creek	116.5	south
122 Mile Creek (Blacktail)	122.0	north
Stone Creek	132.0	north
Tapeats Creek Thunder River	133.7	north
Tapeats and Thunder River Caves	133.7	north
Deer Creek	136.2	north
Kanab Creek	143.5	north
Matkatamiba	147.9	south
Havasu Canyon	156.8	south
National Canyon	166.5	south
Fern Glen	168	north
Mohawk Canyon	171.5	south
185-Mile	185.5	north
Granite Park	208.6	south
Spencer Canyon	246	south
Grapevine Wash	279.0	south

With the exception of a few species like Tamarix and Pluchea, most of the plant life in the riparian zone along the river is sensitive. Harsh growing conditions inhibit regeneration once an area is disturbed. Biologically sensitive areas within the canyon are areas with high densities or diversities of plant and animal life, or areas which provide a unique element required for reproduction and survival of indigenous populations.

Rising from the riparian community along the river is the desert scrub community of the Inner Gorge. Its plants are characteristically catclaw, mesquite, saltbrush, krameria and a few tenacious clumps of various cacti and grasses.

Above the Inner Gorge in the eastern and central portions of Grand Canyon National Park (Units 2, 3, 4, and 5) there is a bench or platform called the Tonto Plateau. This area contains the flattest continuum within this section of the canyon, extends along both sides of the river above the Inner Gorge, and is a mile wide in some places. The Tonto Plateau is predominantly below an elevation of 4,500 feet and is cut by numerous canyons leading to the Inner Gorge. The predominant plant of this community is blackbrush. Other common plants are desert thorn, burrobrush, wolfberry, bursage, agave, and narrowleaf yucca. Some mammals commonly found within the desert scrub community of the Tonto Plateau are: white-tailed antelope squirrel, cliff chipmunk, canyon mouse, cactus mouse, desert wood rat, white-throated wood rat, Ord's kangaroo rat, desert shrew, silky pocket mouse, ringtail, spotted skunk, rock squirrel, spotted ground squirrel, Gunnison's prairie dog, black-tailed jackrabbit, grasshopper mouse, bighorn, and the feral burro.

A woodland that consists primarily of pinyon and juniper trees occurs along each rim above the canyon walls and on some of the buttes and ridges within the canyon. This pinyon-juniper association forms a belt between desert scrub of the Inner Canyon and the yellow pine woodland on the rims. The pinyon-juniper community receives less water and warmer weather than the yellow pine woodland. Some plants of this community are pinyon, Utah juniper, cliff rose, broadleaf yucca, serviceberry, rabbit brush, ephedra, and blue gramma. Typical mammals to be found in the pinyon-juniper association are pinyon mouse, Stephen's wood rat, desert cottontail, mountain lion, bobcat, rock squirrel, cliff chipmunk, gray fox and mule deer.

The yellow or ponderosa pine association is more extensive on the North Rim than it is on the South Rim. On the North Rim of the canyon this community is usually found between an elevation of 7200 and 8200 feet, and on the South Rim between 7000 and 7400 feet. The yellow pine forest is usually open and grasses are present. Rainfall is more than 20 inches annually and the mean temperature during the growing season is about 60°F. Yellow pines occur as an isolated stand on Shiva Temple

within the canyon and in a nearby isolated state on Powell Plateau. The yellow pine forest is small within the boundaries of the park on the South Rim, but extensive stands exist within the national forest contiguous with the park boundary.

Some typical plants in this community are: yellow (ponderosa) pine, Gambel oak, locust, mountain mahogany, blue elderberry, creeping mahonia, and fescue. Mammals common to the yellow pine forest are the Abert squirrel on the South Rim and the Kaibab squirrel on the North Rim, Merriam's shrew, striped skunk, Uinta chipmunk, golden-mantled ground squirrel, Mexican wood rat, bushy-tailed wood rat, Mexican vole, porcupine, Nuttall's cottontail, mountain lion, bobcat, deer mouse, and mule deer.

The spruce-fir forest with an intermixing of aspens occurs on the North Rim (Units 2 and 3) and continues northward onto the Kaibab Plateau. It occurs mostly above an elevation of 8200 feet and is an area of heavy snowfall, cold winters and a growing season of about three months. This area is isolated from other spruce-fir forests. The canopy of the spruce-fir forest is closed and there is little growth of herbs and grasses, with an increased growth of mosses and lichens. Typical plants in this community are Englemann spruce, blue spruce, Douglas fir, white fir, aspen and mountain ash. Some mammals found in the spruce-fir community of the North Rim are: red squirrel, northern pocket gopher, dwarf shrew, long-eared myotis, long-tailed vole, porcupine, and Uinta chipmunk.

Grasses slow the surface runoff of precipitation, retard soil erosion, help maintain soil porosity and provide food for domestic animals and wildlife. Their surface growth is readily consumed by natural or man-caused ground fires, but their root systems usually remain viable and produce surface growth the following season. Elimination of fire from an area may actually cause a reduction in both the kind and amount of grasses capable of reproducing there. Grasses are widely distributed within Grand Canyon and are especially noticeable in the meadows of the North Rim. Both native and domestic grasses are found within the park as can be seen in the following list.

TABLE 8

GRASS SPECIES
GRAND CANYON NATIONAL PARK

Agropyron	Wheatgrass	Blepharoneuron	Pine dropseed
Agrostis	Bentgrass	Bouteloua	Grama
Alopecurus	Foxtail	Bromus	Brome
Andropogon	Bluestem	Calamagrostic	Reedgrass
Aristida	Threeawn	Cenchrus	Sandbur
Avena	Wild oats	Cynodon	Bermudagrass
Beckmannia	Sloughgrass	Danthonia	Oatgrass

Dactylis	Orchardgrass	Oryzopsis	Ricegrass
Deschampsia	Hairgrass	Panicum	Witchgrass
Echinochola	Barnyardgrass	Phleum	Timothy
Elymus	Wildrye	Poa	Bluegrass
Eragrostis	Lovegrass	Polypogon	Polypogon
Festuca	Fescue	Phragmites	Reed
Glyceria	Mannagrass	Secale	Rye
Heteropogon	Tanglehead	Schleropogon	Burrograss
Hordeum	Barley	Setaria	Bristlegrass
Imperata	Satintail	Sitanion	Squirreltail
Koeleria	Junegrass	Sporobolus	Dropseed
Lolium	Ryegrass	Stipa	Needlegrass
Lycurus	Wolftail	Trichachne	Cottontop
Muhlenbergia	Muhly	Tridens	Tridens
Munroa	Buffalograss		

Meadows or mountain grasslands are present in limited numbers on the North Rim. They appear as open, shallow valleys, free of trees, with a large variety of grasses and forbs that are surrounded by spruce, fir and aspen. Soil moisture is high in the meadows from the melting of heavy snow cover. Some of the prominent plants in the mountain grassland community are mountain muhly, blue gramma, black dropseed, squirreltail and pine dropseed. Some of the resident mammals are the long-tailed vole, northern pocket gopher, long-tailed weasel, least chipmunk and Uinta chipmunk. Members of one of the largest deer herds in the United States can often be observed browsing at the edges of these meadows. Most of these meadows have been damaged by being cut by primitive roads.

The rocky and rugged topography along the Colorado River in the Lake Mead addition to the park (Units 1 and 2) supports a creosotebush community on soils that are typically of gray alluvial origin and generally have high salt-alkali content. A caliche hard pan is sometimes present. The sparse vegetative cover in this community is dominated by creosotebush (Larrea iivaricata) and burrobush (Franseria dumosa). Mohave yucca, desert holly, saltcedar, ocotillo, Mormon tea, barrel cactus, prickly pear cactus, cholla cactus, indigo bush, saltbush, brittlebush, ratany, buckwheats, sunflowers, mustards, and legumes are common or locally common. Timely precipitation can result in profusions of such plants as wild heliotrope or phacelia, globemallow, plantain, monkey flower, desert marigold, sunray, fiddleneck, poppy, purple aster, and several different primroses.

Diurnal lizards and nocturnal snakes are relatively common, especially the side-blocked lizard, whiptail, desert iguana, zebra tail, red racer, sidewinder, and speckled rattlesnake. The Gila monster has been reported as far upstream as Granite Park and reaches the northerly limit of its range in this area. The desert tortoise is present, but not common.

The diversity of bird species within the creosotebush community is great, but population densities are generally low. Gambel's quail, raven, desert sparrow, roadrunner, horned lark, cactus and rock wrens are commonly seen along the river. Five species of bats are common to abundant, as are seven species of small rodents. Blacktail jackrabbits and the desert cottontail are common. The desert bighorn is a transient through this community and the coyote, kit fox, badger, and bobcat are relatively common residents. The feral burro is also present in this community.

The blackbrush community is found at slightly higher elevations than the creosotebush community which it resembles. The soils are generally more porous, have lower salt and alkali contents, and are more permeable than the soils of the creosotebush community, and have slightly higher organic contents. While the herbaceous cover is similar to that in the creosotebush community, such grasses as Muhlenbergia, Bromus, and various gramma grasses are more abundant. Reptiles are slightly less numerous than in the creosotebush community. Sage sparrow, ladder-backed woodpecker, raven, cactus and rock wrens are the most commonly seen resident birds.

An extension of the Northern Desert Sagebrush community extends into northern Arizona from the Great Basin and into the Sanup Plateau and Tuweep District of the western and central park (Unit 2). The dominant plant is big sagebrush (Artemesia tridentata) in nearly pure stands with various grasses and a few scattered pinyon and juniper trees in minor drainages. Other vegetation includes several cacti (Opuntia sp.), snakeweed (Gutierrezia sarothrae), cryptantha (Cryptanta sp.), spiderling (Boerhaavia gracillima), aster (Aster sp.), dyssodia (Dyssodia sp.), and bent grass (Agrostis sp.). The Tuweep District is more heavily populated by native wildlife than is the Sanup Plateau. The dominant wildlife found in the area is gophers, mice, coyotes, badgers, and cottontail and blacktail jackrabbits. Bighorn sheep are thought to be transients throughout most of this community. A small herd of antelope lives in the Tuweep District, as do mule deer. Feral burro use of this community is not as heavy as it is at lower elevations along the Colorado River. North of the park, from Parashant Canyon to the Tuweep District, this community is under significant grazing pressure from domestic animals.

A Palo Verde-cacti-burr sage community occurs along the lower portions of the Kanab Creek addition to the park (Unit 2) and along portions of the Colorado River near its junction with Kanab Creek.

No adequate or extensive vegetational maps are available for Grand Canyon National Park. The data shown in Appendix F reflects information only for the park prior to the Enlargement Act of 1975 (P.L. 93-620) and is given to show the state of knowledge at that time. Appendix G gives the modern vegetational terminology currently being used for Information Base inventories within the park.

Pending the completion of the park's Natural Resources Management Plan, all plants and animals are protected according to policy guidelines for natural areas. Special programs deemed necessary for the perpetuation or maintenance of plant or animal species in wilderness areas will be enunciated in the park's Resources Management Plan.

J. ENDANGERED OR THREATENED SPECIES

The following animals, observed within Grand Canyon National Park, are on the United States List of Endangered Fauna, maintained by the Secretary of the Interior, and are in danger of extinction at this time:

Southern bald eagle	Haliaeetus leucocephalus leucocephalus
American peregrine falcon	Falco peregrinus anatum
Humpback chub	Gila cypha
Colorado River squawfish	Ptychocheilus lucius
California brown pelican	Pelecanus occidentalis californicus

The Kaibab squirrel, Sciurus kaibabensis, the spotted owl, Stirix occidentalis, the prairie falcon, Falco mexicanus, and the Little Colorado spinedace, Lepidomeda vittata, were considered for the threatened species category by the U.S. Fish and Wildlife Service. None of the above have yet been placed on the List of Endangered Species as "Threatened."

In addition, the following species were placed in the "status-undetermined" category in the 1973 "Redbook" on "Threatened Wildlife of the United States." While it has been suggested that they face extinction, not enough information is currently available for a definite determination:

Ferruginous hawk	Buteo regalis
American osprey	Pandion hailaetus carolinensis
Prairie pigeonhawk	Falco columbarius richardsonii
Humpback sucker	Xyrauchen texanus
Gila monster	Heloderma suspectum

The desert tortoise, Gopherus agassizi, has suffered drastic population declines in the Utah-Nevada-Arizona junction area and should be considered as locally endangered within the park.

A number of endangered or threatened species of plants are known from Grand Canyon National Park. Species endemic to the area or species much diminished in range or habitat and listed as Endangered in House Document 94-51, "Report on Endangered and Threatened Plant Species of the United States," are as follows:

Palmer Amsonia	Amsonia Palmeri
Goldenweed	Haplopappus salicinus
Draba	Draba asprella var. kaibensis
Plains cactus	Pediocactus bradyi
Scouler catchfly	Silene rectiramea
Milkvetch	Astragalus cremnophylax
Phacelia	Phacelia filiformis
Wild buckwheat	Eriogonum darrovii
Wild buckwheat	Eriogonum thompsonae var. atwoodi
Wild buckwheat	Eriogonum zionis var. coccineum
Primrose	Primula hunnewellii
Clute penstemon	Penstemon Clutei

The following plants in Grand Canyon National Park are recommended for consideration as a threatened species in House Document 94-51:

Crossosoma	Crossosoma parviflorum
Beavertail cactus	Opuntia basilaris var. longeareolata
Fleabane	Erigeron lobatus
Goldenweed	Haplopappus scopulorum
Actinea	Hymenoxys subintegra
Draba	Draba asprella var. stelligera
Phacelia	Phacelia serrata
Agave	Agave utahensis var. kaibabensis
Flowering ash	Fraxinus cuspidata var. macropetala
Milkvetch	Astralagus troglodytus
Primrose	Primula specuicola
Wild buckwheat	Eriogonum densum
Wild Buckwheat	Eriogonum ovalifolium var. vineum
Columbine	Aquilegia desertorum
Wild rose	Rosa stellata

K. RESOURCE MANAGEMENT

The early history of attempts to preserve the natural resources within Grand Canyon National Park can be termed selective and protective in nature. To keep the park green, all fires were extinguished and insect or disease damage severely controlled. To protect wildlife, no hunting was allowed. Certain "favored" species of plants and animals were given special attention and allowed to flourish, while others were actively discouraged and attempts made to eliminate them. Change, which did not interfere with the effective preservation and display of the "favored" species, was in general accepted or ignored. Often the very efforts made to preserve a natural system brought on unplanned and undesired changes. A tracing of some of the more prominent situations will aid in clarifying the present natural resource condition of the park.

1. Grazing

The land settlement history of the Grand Canyon area has had much to do with the range conditions as they exist today. The town of Williams, Arizona became an important sheep and cattle center about 1876. There is no doubt that herders had livestock within the present boundaries of Grand Canyon and so began a period of heavy range use of what were to be park lands. As visitation to the canyon by tourists increased, the public became more demanding that the area be protected for its aesthetic values. The first step in this direction came in 1893 when President Harrison declared the area a Forest Preserve with boundaries that embraced all of the scenic portions of what is now Grand Canyon National Park. This did not appreciably reduce grazing and, even after President Theodore Roosevelt proclaimed Grand Canyon to be a national monument in 1908, heavy livestock use continued. The monument was made a national park in 1919 and, except for some trespass livestock, range use by these animals was halted by the mid-1930's.

Until 1975, the members of the Havasupai Tribe held grazing privileges on 56,000 acres of Grand Canyon National Park and Grand Canyon National Monument. The most recent livestock count indicated that 138 cattle and 322 horses were grazing on this land. The Grand Canyon National Park Enlargement Act of 1975 deleted 83,809 acres from the park and monument for addition to the Havasupai Reservation and provided for special use grazing permits on approximately 95,300 acres of land in the Great Thumb Area. Although range limitations and allowable grazing pressures have not been established for the Havasupai Land Use portions of the park, the grazing capacities on this range are considered low. Stock water is minimal, the forage is of low quality, and the soils are of such poor quality that range "improvements" would result in little additional yield.

Two individuals hold three life-tenure permits for grazing in the Tuweep District of the park. Five individuals hold grazing permits on lands added to the park by P.L. 93-620 (250,000 acres). One of these permits, in the Kanab Creek addition, will expire in 1976, and the other permits will not be renewed beyond 1984 as prescribed by P.L. 93-620.

The land being used by domestic livestock within the park does not provide a bountiful harvest. The lack of naturally occurring surface water combined with the low productivity and slow regrowth of vegetation, and shallow, infertile soils, make this land poor to very poor under most grazing classifications. A few stock roads and trails and scattered stock tanks are the main evidence that these areas are being used for grazing. As lifetime permits expire, the majority of these roads and trails will be abandoned and the stock tanks breached. No new permits will be granted.

There is prime desert bighorn habitat on the northern portions of the Great Thumb and Tenderfoot Plateaus within the Havasupai Indian Reservation. In these two areas livestock are in direct competition with the desert bighorn for food and water. Preservation of bighorn habitat in these two areas is considered to be essential to the continued existence of bighorn within adjacent portions of the park. The only known competition north of the Colorado River between domestic livestock grazing and wildlife is with a small herd of pronghorn in the Tuweep District, and this competition is very minor.

Trespass grazing by stock belonging to individuals of the Navajo Tribe has been noted in the southeast corner of Grand Canyon National Park. Thin soils and moisture deficits, as with other areas in the complex, make the land and vegetation unresilient to this impact, and native plants are readily replaced by "nuisance" species such as Salsola kali (tumbleweed), an exotic indicator of disturbance. Significant livestock trespass also occurs within the park on the Kanab Plateau from adjacent lands.

2. Deer

When livestock grazing on the South Rim was reduced with establishment of the national park in 1919, the small deer population began to increase rapidly. Increased forage and a transplant of mule deer from the North Rim further bolstered the population. By the 1930's accelerated growth was due to construction of earthen watering tanks and to fencing the park boundary to exclude cattle. Insufficient stock tanks on adjoining national forest lands for use by livestock and native wildlife forced deer into the park where competition was non-existent. Water from the sewage disposal system became available, and the South Rim deer herd soon exceeded the carrying capacity of the range. Destruction of park vegetation followed. In addition, food-seeking deer increased in developed areas and on roadsides, creating public safety hazards.

From 1944 to the 1960's, deer were live trapped, relocated to nearby Indian reservations, or as a last resort, killed by park rangers. The direct reductions were limited to deer in isolated areas and those ailing or crippled by park motorists.

Deer on the North Rim were historically hunted by the Kaibabits Indian Tribe during the summer, and hides were traded to the Navajo and other nearby tribes. This ancient process of eliminating about 800 deer annually is thought to have resulted in a stabilized deer population.

Records clearly indicate that the Kaibab deer range began to deteriorate with the introduction of extensive herds of livestock. By 1887, at least 200,000 sheep, 20,000 cattle, and "many" horses were utilizing the

lands formerly occupied only by mule deer, pronghorn antelope, and other native wildlife.

The purported "unlimited" supply of forage rapidly declined and led to the establishment of the Kaibab Deer Preserve. One objective was to preserve the mule deer who were decreasing at an alarming rate. The preserve was, however, the first step in the long line of mistakes which had serious effects upon the native wildlife and their habitat. Deer hunting was prohibited and an intensive elimination of all predators followed. The wolf was exterminated and many thousands of cougars, coyotes, and bobcats were taken over a 30-year period. The increased food supply, the near extermination of natural enemies, and the elimination of hunting resulted in a population explosion. By 1924, an estimated 100,000 deer had devastated their range, and the inevitable population decline began. It was estimated that 60 percent of the herd died during the winters of 1924-25 and 1925-26, due to malnutrition and disease.

Permit hunting and a deer reduction program by Government hunters on the national forest began in 1924. Public hunting continues today, outside the park, where a herd of about 10,000 to 12,000 deer is felt to be acceptable.

Deer control programs within the park have not been recommended nor carried out since the winter of 1963-64. Population levels continue to be static on both rims. Park control efforts are now limited to sporadic live captures and transplants of nuisance or dangerous deer from areas of concentrated visitation and to dispatch ailing or injured animals alongside park roadways.

It is felt that a deer management program which includes flexible public hunting quotas on adjoining national forests and national resource lands, where the major deer ranges occur, will complement the less desirable deer habitat found within the park. If this preferred means of controlling deer numbers is inadequate, some removals from within the proposed park wilderness may become necessary. Several methods such as trapping and removal or direct reduction would be considered.

3. Desert Bighorn

The desert bighorn is a species surviving under conditions which are drier and much more severe than those which favored its original penetration into the southwestern United States. It must not be assumed that because desert bighorn live in the arid, rocky, poorly vegetated, and poorly watered habitat of the park that this is the most optimum habitat for them. The bighorn is adaptable and has been able to hang on and survive under conditions far below optimum for the species and in many instances too extreme for other large mammals.

Within Grand Canyon National Park the bighorn is found primarily below the rims in rough, rocky and broken terrain, cut by numerous gullies and canyons. The bighorn will also occupy the open brushlands of the Tonto plateau and the Esplanade and may range into the open woodland of pinyon and juniper in upland areas in search of food. Four factors are basic to bighorn habitat - food supply, water, escape terrain and living space. Bighorn inhabit all areas of the park proposed for wilderness except for the heavily forested North Rim.

Since many plant species in the desert only produce food for the bighorn during certain seasons or only during certain favorable years, a wide range of habitat should consist of a wide variety of plant species and should be situated within about six miles of permanent water. Grasses are the essential food item in the desert scrub vegetation of the canyon. Forbs are utilized in season while browse species make up only about 10 to 15 percent of the bighorn diet. An adult bighorn can maintain adequate health on the equivalent of three pounds of grass per day.

Competition for food is a complex situation. Domestic livestock and feral burros are diurnal and have similar feeding habits such that competition for food and water does occur. As much of the typical bighorn habitat is inaccessible to cattle, perhaps only 30 percent of the plants in the diets of cattle and bighorn are shared. The more agile burro, however, shares 50 to 60 percent of the plants in the bighorn diet. Cattle, horses, and burros require four to five times the forage consumption of deer and bighorn to survive.

The desert bighorn cannot compete with other animals for water. When other large animals such as the feral burro are present at a waterhole, the bighorn will simply leave without drinking. Bighorn also prefer to have a wide open space around their drinking place so they can see for long distances, and even then will approach a waterhole with caution. Necessity, however, brings them to smaller, enclosed drinking sources.

The primary source of water for the bighorn in the canyon is the Colorado River. The easiest access routes to the river often coincide with beach areas or the mouths of tributary canyons where boating parties stop to camp, have lunch, or explore. The sighting of desert bighorn by a river party is always a time of excitement and sometimes vigorous pursuit for photographs. The river is heavily used by river parties during May and June, which are normally drought months, and thus coincide with the bighorn's dependence upon this permanent source of water.

Feral burro reduction programs and the reduction of trespass livestock grazing have been the only resource programs aimed at improving the lot of the desert bighorn within the park. Range extent and population figures have yet to be established for the park, but observational data is currently being collected.

Before the 1950's, the desert bighorn sheep was totally protected from hunting within the State of Arizona. Limited harvesting through hunting began in 1953 on a one-animal-per-lifetime basis. This animal may now be hunted on the Hualapai Reservation and on other lands surrounding the western portions of the Grand Canyon.

4. Pronghorn Antelope

Pronghorn antelope were at one time abundant in the pinyon flats and flat, open grass and brushland between the San Francisco Peaks and the South Rim and over the Kanab Plateau between the Vermillion Cliffs and the Colorado River. Pronghorns have never been especially numerous within the park because of the nature of the terrain, forest vegetation, and the absence of much free water. A small herd maintains itself in Toroweap Valley in the Tuweep District and obtains water from small stock tanks. Transplanting has been done on the Coconino Plateau south of the park and antelope are sometimes seen south of Red Butte or along the primitive road to Hualapai Hilltop.

The pronghorn are basically fleet-footed animals of open grass and brushlands where they can graze peacefully on their favorite vegetation while keeping a watchful eye on possible sources of danger. The pronghorn utilizes a wide variety of foods, eating both grass and brush. Some of the preferred foods include sagebrush, squawbush, saltbush, Apache plume, winterfat, gramma grasses, tobosa, squirreltail and cheat grass. Range conditions, rainfall, time of the year, etc. have a great deal to do with what a particular pronghorn will be eating as he wanders over his normal 20 to 40-square-mile range. No resource management plans are currently directed toward the pronghorn within Grand Canyon National Park.

5. Kaibab Squirrel

The Kaibab squirrel is a rare inhabitant of the North Kaibab Plateau. This particular form of the tuft-eared squirrels is found only on this one plateau and is closely related to his more plentiful counterpart on the South Rim, the Abert squirrel. The Kaibab squirrel is very anti-social and is rarely seen even though he is eagerly sought after by visitors and scientists. He is one of the largest of tree squirrels and is confined by diet to the ponderosa pine forests.

Marked declines in Abert squirrel populations on the Mogollon Rim south of the park were paralleled by Kaibab squirrel declines on the Kaibab Plateau through a low point in the spring of 1973. The decline in the Kaibab squirrel population has been 80-85 percent and is still declining, while the population of Abert squirrels on the Mogollon is recovering.

Studies into the life habits of the Kaibab squirrel during the past ten years have failed to reveal the reasons for this continued decline within the park portions of its range.

6. Transient and Exotic Animals

Wild turkey was practically eliminated from its historical ranges in Arizona as early as 1903. Under the Wildlife Restoration program of the Arizona Game and Fish Department, this bird is now being stocked and returned to its former haunts. The wild turkey is exotic on the North Rim of Grand Canyon; however, nearby transplanting programs have allowed this bird to proliferate and spread into proposed wilderness Units 2 and 3 where suitable habitat exists for it. Summer habitat is the 7,000 to 9,000-foot elevations, while winter habitat is from 4,500 to 7,000. The range preference is mostly a matter of the availability and abundance of food coupled with the shy nature of the bird. Its principal food consists of grass seed, ponderosa pine and oak mast, vegetable matter, berries, and insects.

Approximately 200 head of bison are maintained on the grazing lands of Houserock Valley between the North Rim and Marble Canyon. Bison in excess of the range carrying capacity are cropped through hunting every two years. There have been no problems of trespass by these animals upon the adjacent park lands in proposed wilderness Unit 3.

Black bears inhabit most of the higher mountain ranges in Arizona with the notable exception of those areas north of the Grand Canyon. They are omniverous and will eat nearly anything which proves convenient. Bears are transients on the South Rim, where they enter the park from the Coconino Plateau. Their normal rarity is such that they present no problems for resource management or backcountry hikers. However, recent efforts have been made by various sportsmen groups to have the black bear introduced into the forests north of the North Rim of the Grand Canyon. Should black bear be released in the North Kaibab, it would not be too long until they became residents of the North Rim of the park.

7. Cave Management

The most pristine wilderness resource throughout the park is found underground. The feeling of remoteness, solitude, and isolation from the works of man is complete within a wild cave. In addition to providing a unique recreation experience, caves can be used for basic and applied, non-destructive research. Because of their simplicity, underground environments are easily defined and can be studied "in toto" toward solving problems in ecology, evolution, and mineralogy. Cave studies also provide information on geology, karst, hydrology, paleontology, and archeology.

Caves are fragile resources which can be endangered by both carelessness and intentional vandalism. All contents of a cave - formations, life, and floor deposits - are essential for its enjoyment and interpretation. Once these values are gone they cannot be recovered. With a few exceptions all caves in the park are classified as outstanding natural areas, and are managed primarily for their wilderness exploration values.

Bat Cave, near river mile 265 in proposed wilderness Unit 2, has lost much of its wilderness character because of past guano mining activities in its entrance portions. Roaring Springs cave, in the non-wilderness, cross-canyon corridor, is closed to public entry because it is the water supply for the North and South Rim developed areas. Stanton Cave, in proposed wilderness Unit 3 near Vaseys Paradise in Marble Canyon, has been gated to protect archeological and paleontological material from disturbance. Other known caves needing special forms of protection or restrictions upon entry are: Muav Caves, near the Colorado River in the extreme western portion of proposed wilderness Unit 2, because of their archeological content; nearby Rampart and Vulture Caves for their paleontological evidence pertaining to the Shasta Ground Sloth; and Mother Cave, in proposed wilderness Unit 5 near the cross-canyon corridor, for its archeological contents.

Caving permits are required for entry into wild caves in the park and scientific collection is professional, selective, and minimal. Collecting specimens for display or study collections is not justified even if the specimens are previously broken or dead because they are part of the delicately balanced cave ecosystem.

8. Fire Management

The presence or absence of natural fire within an ecosystem is one of the ecological factors which shape and perpetuate the plants and animals native to that ecosystem. Natural fires have co-existed with plant and animal communities for millions of years, and the considerable amount of scientific research on the role of fire in the natural environment indicates it is an essential element in most plant communities. Man's interference with the natural role of fire at Grand Canyon National Park over the last seventy years has brought about unnatural changes in the varied environments.

In the absence of fire, thick stands of young pine, spruce, and fir have closed in upon the once open, park-like stands of forest on the North Rim. The lack of natural burning allows tree crowns to close in and shade out many forage plants which support much of the forest animal population. Dense stands of trees allow the rapid spread of such forest infestations as dwarf mistletoe and the deep accumulation of forest

litter increases the habitat for some forest insect pests. The crowding of trees contributes to a general weakening of growth rates and a lowering of resistance to disease and insect infestations. The large quantities of forest floor fuels which have accumulated because of fire suppression activities by the Forest Service and the National Park Service have made many of the park's forested areas veritable tinderboxes and unnaturally susceptible to holocaust forest fires.

Fire acts on the forest to reduce fuel accumulations, lessen fire hazards, and release nutrients into the soil. In fire-dependent forests such as ponderosa pine, fire burns away thick layers of duff and prepares the substrate for pine seed germination. Fire also thins crowded stands of saplings and eliminates the less fire-resistant plants from the forest.

The staff of Grand Canyon National Park is developing a fire management program which is designed to reintroduce fire as a natural force in the ecosystems of the park, to maintain these ecosystems in a naturally evolving state, and to reduce the probability of holocaust forest fires. Certain areas of high fire danger will be treated with controlled burning to reduce the unnatural fuel buildups so that they may withstand subsequent natural fires. An environmental assessment is being prepared in conjunction with the fire management plan and is based upon data from the park's ongoing fire research program.

The plan divides the park into five fire management zones according to vegetation types, fuel loadings, and topography. The five zones are shown on page II-45.

Zone A: This fire management zone includes Shiva Temple, the southwest portion of Powell Plateau, the rim at Kanab Creek, the uplands of the Tuweep District, the area west of Grand Canyon Village from Horsethief Tank to the Havasupai Reservation, east of Grand Canyon Village from Buggeln Hill to the east park boundary and north to Cape Solitude.

All naturally caused fires in this zone will be allowed to burn except where they threaten human life, endanger physical developments, or may escape from the park. No controlled burning is planned in this zone. The vegetation consists primarily of pinyon pine and juniper trees with a light ground cover of bunch and range grasses. Fuel accumulations are low and the sparse vegetation makes the possibility of a forest fire burning out of control slight. Lightning-caused fires occurring in this zone cause 3-6 fires per year and rarely exceed an acre in size.

Zone B: This fire management zone consists of all of the Inner Canyon below the top of the Redwall Limestone, all of Marble Canyon, and the Tuweep District. The cross-canyon corridor along the Kaibab and Bright Angel trails is excluded from this zone. All naturally caused fires in

LEGEND

NATIONAL PARK BOUNDARY
RECREATION MANAGEMENT AREA (N.R.A.)
MAJOR ROAD

ZONE A
ZONE B
ZONE C
ZONE D
ZONE E

R 13 W R 12 W R 11 W R 10 W R 4 W R 3 W R 2 W R 1 W R 1 E R 2 E R 3 E R 4 E R 5 E R 6 E R 7 E

T 39 N T 35 N T 34 N

MOHAVE COUNTY
COCONINO COUNTY

Kanab Creek

GLEN CANYON N.R.A.

NAVAJO BRIDGE

VERMILION CLIFFS

89 ALT

89

89

67

KAIBAB NATIONAL FOREST

KAIBAB PLATEAU

GREAT THUMB MESA

KANAB POINT

TOROWEAP VALLEY

WHITMORE CANYON

LAKE MEAD N.R.A.

HAVASUPAI INDIAN RESERVATION

Cataract Creek

POINT IMPERIAL

NAVAJO

CAPE SOLITUDE

INDIAN

BRIGHT ANGEL POINT

COLORADO RIVER

PHANTOM RANCH

CAPE ROYAL

HERMITS REST

GRAND CANYON VILLAGE

DESERT VIEW POINT

RESERVATION

Little Colorado River

180

64

64

KAIBAB NATIONAL FOREST

GILA & SALT RIVER MERIDIAN

SANUP COLORADO SEPARATION CANYON

PLATEAU

COCONINO COUNTY

Diamond Creek

MOHAVE COUNTY

HUALAPAI INDIAN RESERVATION

N

10 MILES
15 KILOMETERS

KILOMETERS MILES

GILA & SALT RIVER MERIDIAN

FIRE MANAGEMENT ZONES

GRAND CANYON NATIONAL PARK

Mohave And Coconino Counties
ARIZONA

113	40,042
DSC	JUNE 76

this zone will be allowed to burn themselves out except under conditions of extreme fire danger of conditions or conditions which endanger human life. No controlled burning is planned for this zone. The vegetation of Zone B is sparse and consists of canyon chaparral, desert scrub, and scattered juniper trees. The Colorado River and the few side streams that flow into it in this zone are lined with riparian plant species and grasses. The cliffs and large outcrops of barren rock provide natural firebreaks within the various plant associations of this zone. The natural fire frequency within this zone is from one to two fires per year.

Zone C: This zone includes the ponderosa pine forests of the North Rim on Walhalla, Powell, and Rainbow Plateaus, and on Tiyo, Widforss, Sublime, and Swamp Points. Controlled burning will be carried out along lines of scientifically tested fire prescriptions to reduce the present unnatural fuel accumulations and to prepare the ponderosa forest for the tolerance of natural fires. This zone is heavily wooded and an average of 26 fires per year begin naturally in this forest.

Zone D: This zone contains the spruce-fir forests of the North Rim and extends from the north park boundary southward to fire roads W-1 and W-4. All fires in this zone will be suppressed and heavy fuel buildups will be reduced by thinning, limbing, piling, and burning. This zone is densely wooded and contains several large, upland meadows. The natural fire frequency within this zone is from one to two fires per year.

Zone E: This zone consists of all developed areas and historic resources within the park. It includes Grand Canyon Village, Desert View, Bright Angel Point, the developments in Toroweap Valley, and the cross-canyon corridor of the Kaibab and Bright Angel trails. All fires within these areas will be suppressed.

L. CULTURAL RESOURCES

1. Archeological

The archeological resources within the park are of primary scientific and historic value. Artifacts and the remains of dwellings illustrate the adaptation of man to his natural environment in the Grand Canyon region. The initial occupation of the canyon area began about 4,000 years ago, as is evidenced by split-twig figurines found in a number of dry caves. These figurines are thought to have been made by people of the Pinto Basin Complex, one of the Desert Culture Traditions.

Evidence has not been found to indicate human activity in the canyon for several thousand years following the figurine makers. The primary

occupation of the Grand Canyon area occurred between A.D. 700 and 1200. The map on page II-48 shows the approximate location of the various cultural groups during this period of occupation.

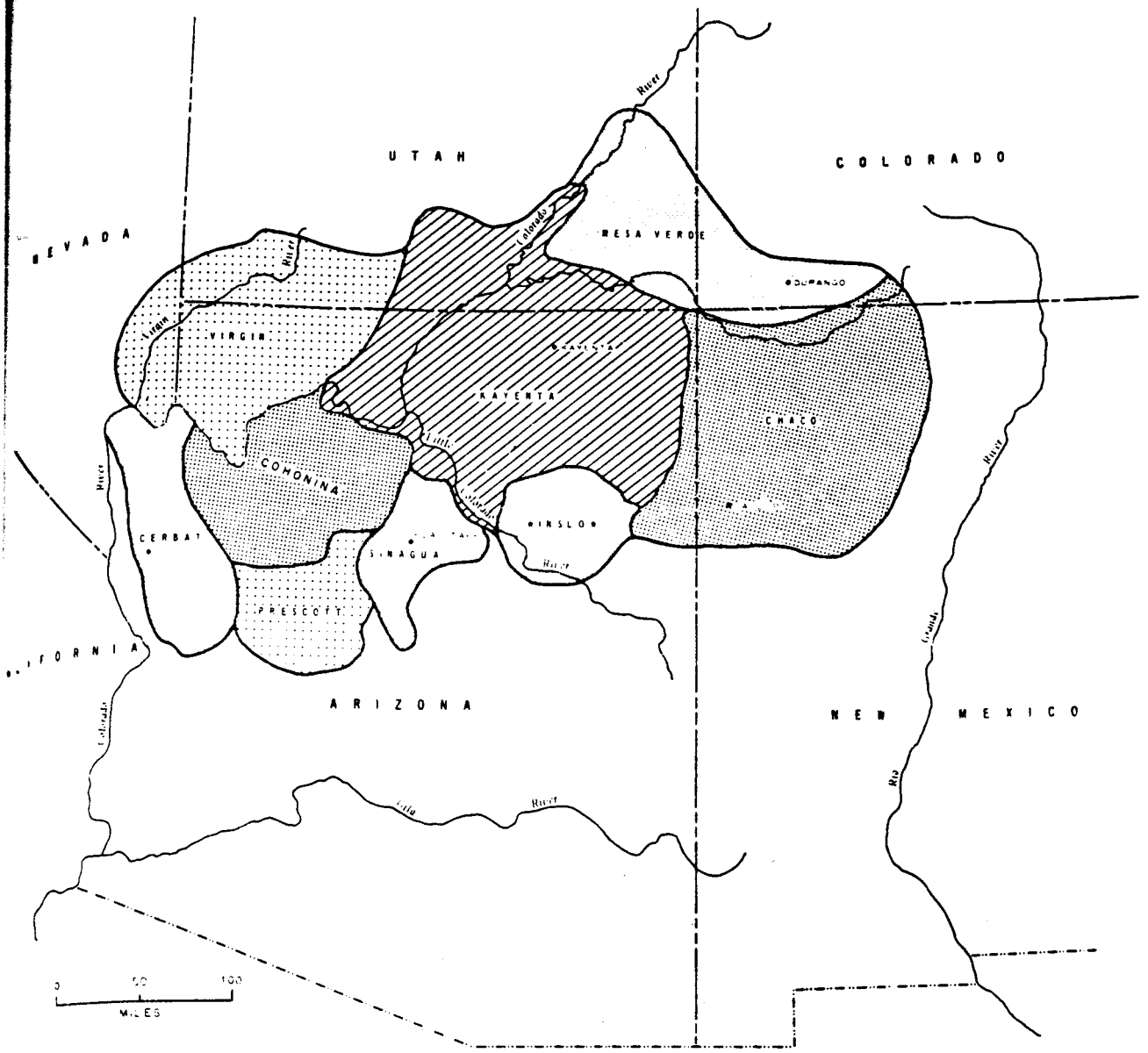
The Kayenta Anasazi made sporadic explorations into the area and sometimes lived in the inner recesses of the canyon on a limited seasonal basis from slightly before A.D. 700 to about A.D. 1000. The Cohonina were settling in selected locations near the South Rim at about the same time. The Kayenta Anasazi moved into the area in strength about A.D. 1000 and by A.D. 1100 they were well established on both rims and within the canyon.

The people of the Cerbat Tradition occupied the riverine and desert environment west of Grand Canyon until about A.D. 1150, when they began to move eastward, slowly supplanting the Cohonina Tradition - consuming or driving it out. The Virgin Anasazi appeared in the northwestern portion of the park about A.D. 900 and their population increased until about A.D. 1130 to 1150, when they apparently moved southeastward into the Kayenta Region.

Between A.D. 1150 and 1200 there was a general abandonment of the Grand Canyon as a place to live. The Cerbat, however, remained and expanded their influence into the upland region to the south and east. From A.D. 1200 until the present the Grand Canyon has been used sparsely by the Hualapai and Havasupai descendants of the Cerbat on the south side of the canyon, and by the Southern Paiute, who moved into tributary canyons on the north side which had been abandoned by the Virgin Anasazi. The modern Hualapai and Havasupai Reservations bound the park along its southwest portion. From time to time, the Kayenta Anasazi and their Hopi descendants have entered the eastern portions of the canyon near the mouth of the Little Colorado River for religious purposes and to gather salt. The modern Navajo Reservation adjoins the eastern boundary of the park and they likewise have traditionally utilized portions of the canyon for religious purposes.

Major areas within the park which have been studied for their archeological resources are Tusayan Ruin, Stanton, Prayerstick, and Muav Caves, Unkar Delta, and the uplands of the Tuweep District. The park may well contain clues to solutions for many unresolved archeological research problems encountered in other parts of the Southwest.

As of the spring of 1976, several Executive Order 11593 surveys have been conducted at Grand Canyon National Park to identify extant cultural resources. Archeological surveys have been made by Robert Euler, "Archaeology of Bright Angel Point-Grand Canyon National Park," 1975,



—Approximate distribution of prehistoric cultural traditions in the northern Southwest at ca. A.D. 1150.

the Museum of Northern Arizona, "Archaeological Investigation . . . Cross Canyon Corridor Survey . . .," 1974, South Utah State College and others. They report that the Grand Canyon area is rich in prehistoric sites. Additional surveys will be programmed in the future to comply with Executive Order 11593.

2. Historical

All areas have a past, and thus a history. Although the archeological record indicates a very early human interaction with the Grand Canyon, it has been only during the past 75 years that extensive organized activity has occurred. The historic resources of Grand Canyon relate primarily to the establishment and development of the Grand Canyon as a national park.

Recorded history of the Grand Canyon began with its discovery in 1540 by Don Lopez de Cardenas, one of Coronado's captains, and 12 followers who were seeking the fabled wealth of the Seven Cities of Cibola. Fathers Dominguez and Escalante crossed the Colorado River in Glen Canyon in 1776 and in that same year Francisco Tomas Garces visited the Havasupai Indians during a traverse south of Grand Canyon. American fur traders made forays into the Grand Canyon region during the early 19th century. After the war with Mexico, the United States became owner of the region in 1848 by the Treaty of Guadalupe Hidalgo. The first comprehensive report on Grand Canyon country resulted from the work of a War Department expedition of 1857-58 headed by Lieutenant Joseph C. Ives. His mission was to ascend the Colorado River and report on its navigability.

Major John Wesley Powell and nine companions won lasting fame as a result of their daring descent by boat of the Colorado River in 1869. Their trip began at Green River, Wyoming, and transitted the river from there through the Grand Canyon. Powell repeated the trip again in 1871-72. His were scientific explorations and much worthwhile and illuminating information was gathered in spite of the hardships involved. A U.S. Army expedition led by Captain George Wheeler passed immediately south of the canyon in 1871 as they were mapping potential railway routes.

Prospectors, miners, cattlemen, entrepreneurs, and others seeking to exploit the canyon's resources came to the canyon in the decades following Powell's famous expeditions. Tourist travel to the canyon began in the 1880's when John Hance, a prospector and miner turned dude wrangler, began to improve the Indian trails into the canyon. A hotel was built at Grandview Point in 1882 and the Bucky O'Neill Cabin was built as the first tourist accommodation near the rim in the area of the present Grand Canyon Village.

The Atlantic and Pacific Railroad (now Atchison, Topeka, and Santa Fe) completed trackage to the South Rim in 1901; the first automobile arrived at the South Rim in 1902; and by 1906 the El Tovar Hotel was providing lodging, dining, and other services to a relatively affluent visitor population. By 1910 a small village had grown up around the railroad station and the El Tovar Hotel. Barns, stables, and a blacksmith shop were built on the outskirts of the village. Enterprises selling "objets d'art" (Verkamps and Hopi House) and photographs (Kolb Studio) were established adjacent to the hotel on the rim. A general supply store was built and a cabin development was begun west of the present Bright Angel Lodge to provide lodging for those who could not afford the luxury of the El Tovar Hotel.

Because it was remote and difficult to reach, the North Rim did not develop as early as its southern counterpart. Utah residents long considered the North Rim and the Arizona Strip as Utah's southern boundary and it was not until Arizona Statehood in 1912 that this issue was finally settled. Cattlemen from the Grand Canyon Cattle Company and the Kaibab Land and Cattle Company and a few visitors such as geologists and the United Order of Orderville were the only people to view the forests and canyons of the North Rim until the early twentieth century. In 1903, E. D. Wooley and Jim Emmitt organized the Cross Canyon Transportation Company, promoted a cross-canyon trail, and rigged a cable car crossing of the Colorado River at Rust's Camp near the present Phantom Ranch linking the two sides of the canyon.

The movement to protect the canyon began in 1887 when Senator Benjamin Harrison of Indiana introduced a bill to make it a national park. In 1893, as President of the United States, he established the Grand Canyon Forest Preserve. In 1903 President Theodore Roosevelt visited the canyon and in 1908 he established Grand Canyon National Monument. An act of Congress signed on February 26, 1919 established Grand Canyon National Park, and the Grand Canyon National Park Enlargement Act of 1975 established the present boundaries.

An archeological and historic survey program has been started in the park to comply with Executive Order 11593, Section 2, Responsibilities of Federal Agencies, dated May 13, 1971. After location and inventory, those archeological and historic sites which appear to qualify for listing will be nominated to the National Register of Historic Places. Section 106 of the National Historic Preservation Act of 1966 is applied to all actions within the park, including wilderness proposals. If any future actions involve a site or sites included in or eligible to the National Register, the Criteria of Effect and Criteria of Adverse Effect

will be applied (36 CFR Part 100). The National Register of Historic Places as published in the Federal Register (February 28, 1973, and subsequent issues through February 1976) has been consulted to establish any National Register properties within the enlarged park.

National Register properties which are located in Grand Canyon National Park and the dates they were listed are as follows: El Tovar Stables (9/6/74), El Tovar Hotel (9/6/74), Santa Fe Railroad Station (9/6/74), Superintendent's Residence (9/6/74), Grandview Mine (7/9/74), Hermit's Rest Concession Building (8/7/74), Tusayan Ruins (7/10/74), Water Reclamation Plant (9/6/74), and Ranger's Dormitory (10/5/75). The Grandview Mine is the only National Register property located within a proposed wilderness area (Unit 4).

Recent historical surveys include Ronald J. Johnson and Tony Crosby, "A Cultural Resources Survey of the Cross Canyon Corridor and the North Rim Development Area," 1975. The report recommended that the Grand Canyon Lodge Historic District, the North Rim Headquarters Historic District, and the Cross Canyon Corridor Historic District be nominated to the National Register of Historic Places.

The Secretary of the Interior has determined that the following properties may be eligible for inclusion in the National Register and are therefore entitled to protection afforded by the "Procedures" of the Advisory Council on Historic Preservation (36 CFR Part 800): Old Post Office, Bucky O'Neill Cabin, Kolb Studio, Red Lake Stage Station, and the Salt Cabin at Greenland Lake. This list is not complete or exhaustive, and other sites may be nominated as they are evaluated concerning possible historic or archeological significance.

The following is a list of currently known sites within the wilderness study area which require historic evaluation. Some of these sites may meet National Register criteria when they are fully understood.

Wilderness Unit 1: No significant sites

Wilderness Unit 2:
- Bat Cave Guano Mine
- Muav Saddle Winter Patrol Cabin
- Swamp Point cabin ruin
- Kanabownits Fire Lookout
- Kanabownits Ranger Cabin
- Basin cabin ruin
- Basin corral
- Bass Farm site
- Muav Caves

Wilderness Unit 3: Hance Asbestos Mines
Lava Canyon Silver Mines
Stanton Cave

Wilderness Unit 4: Beamer Cabin
Beamer Trail
Palisade Creek Copper Mines
New and Old Hance Trails
Prayerstick Cave

Wilderness Unit 5: Signal Hill Lookout
Bass Trail
Bass Camp
Hermit Trail
Hermit Trail shelter
Hermit Camp
Hermit Camp tramway ruin
Boucher Camp
Mother Cave

M. SOCIOECONOMIC FACTORS

1. Setting

The Grand Canyon is sparsely settled. The majority of people live in towns with less than 5,000 population or are scattered across the region, living at road junctions, isolated ranches, and Indian Reservations. Thus, the 1,500 or so permanent residents in the Tusayan-Grand Canyon Village form a sizable community in the region. Flagstaff and Kingman are the two largest towns in the region. Their economy is significantly dependent upon tourism, much of which is generated by Grand Canyon National Park and Lake Mead National Recreation Area. The following two graphics depict the counties in which Grand Canyon lies.

Nearby units of the National Park System are Bryce Canyon and Zion National Parks, and Pipe Spring and Cedar Breaks National Monuments to the north, Wupatki, Sunset Crater, and Walnut Canyon National Monuments to the southeast, with Glen Canyon and Lake Mead National Recreation Areas, respectively, bracketing the Grand Canyon on the northeast and southwest.

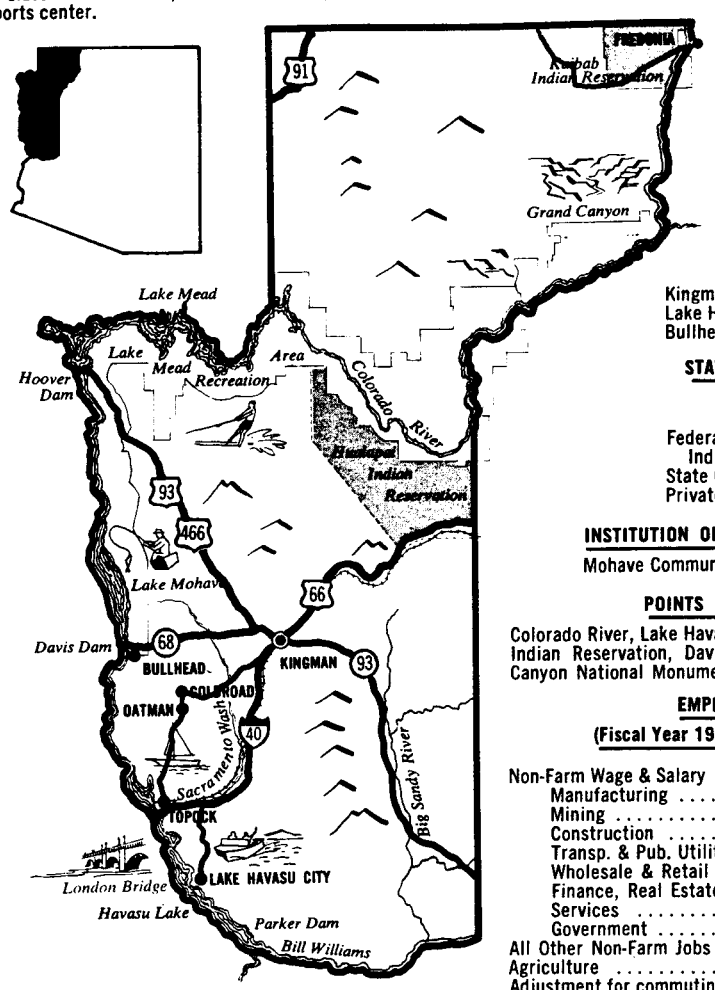
The nearest units of the National Wilderness Preservation System are the Petrified Forest National Park Wilderness to the southeast and the Mazatzal, Sierra Ancha, Sycamore Canyon and Superstition Wilderness areas in national forests of central Arizona to the south.

MOHAVE COUNTY

LAND AREA

8,486,000 acres (13,227 square miles)

Mohave County is one of the four original counties of the Territory of Arizona and was named after an Indian tribe which lived along the Colorado River. It is the second largest county in the state, and topographically most of it is classified as desert, but nevertheless, Mohave boasts of over 1,000 miles of shoreline, and is a great water sports center.



Leading Cities (1970)

Kingman (Cty. Seat)	7,312
Lake Havasu area	5,300
Bullhead City	3,200

STATUS OF LAND OWNERSHIP

As of 1973

Federally Owned	74%
Indian Reservation	7
State Owned	5
Privately Owned	21

INSTITUTION OF HIGHER LEARNING

Mohave Community College, Kingman

POINTS OF INTEREST

Colorado River, Lake Havasu (London Bridge), Hualapai Indian Reservation, Davis Dam, Hoover Dam, Grand Canyon National Monument

EMPLOYMENT

(Fiscal Year 1973 Annual Average)

Non-Farm Wage & Salary	8,050
Manufacturing	1,000
Mining	475
Construction	1,000
Transp. & Pub. Utilities	450
Wholesale & Retail Trade	1,800
Finance, Real Estate	300
Services	1,350
Government	1,675
All Other Non-Farm Jobs	1,175
Agriculture	200
Adjustment for commuting and multiple job holding	900
TOTAL Employed	10,325
Unemployed	
Number	675
Rate	6.1%

County Population Density

2.6 persons per square mile

PRINCIPAL INDUSTRIES

Copper mining, ranching, manufacturing, tourism and travel

ECONOMIC INDICATORS

Indicator	1963	1973	% Change
Population	11,500	32,100	+179.1%
Retail Sales	$21,874,000	$103,623,000	+373.7
Bank Deposits	$10,325,000(*)	$ 72,689,000	+604.0
Vehicle Registrations	8,035	41,885	+421.3
Motor Fuel Consumption (gallons)	14,368,000	36,713,000	+155.5

(*) as of December 20

POPULATION

1970 Census	25,857
1974 Estimate	34,300

Racial Breakdown

White	33,200
Indian	1,000
Negro	—
Other	100
Spanish Heritage	2,300

COCONINO COUNTY

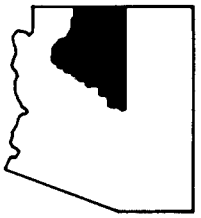
LAND AREA

11,887 acres (18,562 square miles)

Coconino County was named for the Indians of the region. It is the largest county in Arizona, and the second largest in the U.S., but it is one of the most sparsely populated of Arizona's counties. Coconino is characterized by rugged mountains, deep canyons, and thick forests of pine, spruce, pinon, aspen and oak.

INSTITUTION OF HIGHER LEARNING

Northern Arizona University, Flagstaff



POPULATION

1970 Census	48,326
1974 Estimate	62,700

Racial Breakdown

White	45,500
Indian	15,600
Negro	1,400
Other	200
Spanish Heritage	8,300

Leading Cities (1970)

Flagstaff (Cty. Seat)	26,117
Williams	2,386
Page	1,439
Grand Canyon	1,011
Fredonia	798

STATUS OF LAND OWNERSHIP

As of 1973

Federally Owned	78%
Indian Reservation	37
State Owned	9
Privately Owned	13

EMPLOYMENT

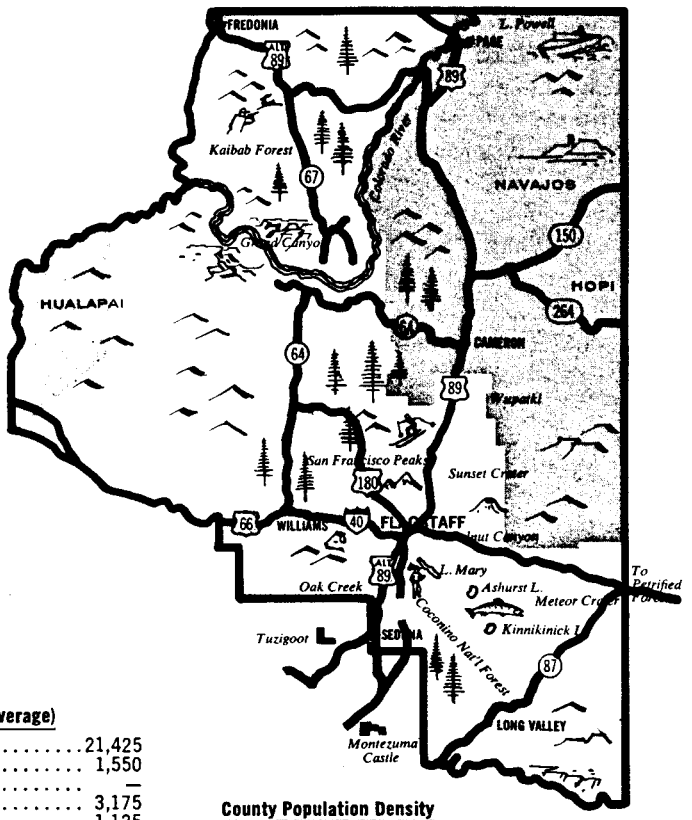
(Fiscal Year 1973 Annual Average)

Non-Farm Wage & Salary	21,425
Manufacturing	1,550
Mining	—
Construction	3,175
Transp. & Pub. Utilities	1,125
Wholesale, Retail Trade	4,375
Finance, Real Estate	550
Services	4,050
Government	6,600
All Other Non-Farm Jobs	1,400
Agriculture	675
Adjustment for commuting and multiple job holding	−2,375
TOTAL Employed	21,125
Unemployed	
Number	1,250
Rate	5.6%

ECONOMIC INDICATORS

Indicator	1963	1973	% Change
Population	43,000	59,500	+ 38.4%
Retail Sales	$71,720,000	$189,134,000	+163.7
Bank Deposits	$32,439,000(*)	$111,510,000	+243.8
Vehicle Registrations	23,630	46,952	+ 98.7
Motor Fuel Consumption (gallons)	33,904,000	67,570,000	+ 99.3

(*) as of December 20



County Population Density

3.4 persons per square mile

PRINCIPAL INDUSTRIES

Tourism, travel and recreation, lumbering, ranching, government business.

POINTS OF INTEREST

Grand Canyon, Oak Creek Canyon, Lowell Observatory, Meteor Crater, Glen Canyon Dam, Mormon Lake, Snow Bowl.

2. Surrounding Land Use

a. Havasupai Indian Reservation

On June 8, 1880, President Rutherford B. Hayes established the first Havasupai Indian Reservation. A technical problem in the Executive Order resulted in a second order on November 23, 1880, but the reservation's boundaries remained unchanged. The reservation consisted of 34,240 acres in the Cataract Canyon-Havasu Creek area. The intent of reserving these lands for the use and occupancy of the Havasupai was to guarantee the Indians a land base for their livelihood and to guarantee white settlers peaceful entry into portions of the Coconino Plateau for homesteading.

With the homesteaders, however, came prospectors, and in 1882 President Chester A. Arthur addressed the problem of mineral rights by reducing the Havasupai Indian Reservation to 518.6 acres. These 518 acres were the Havasupai's traditional farming lands in the bottom of Havasu Canyon, where they grew their crops during the spring and summer months of the year. The stock grazing lands and the hunting and gathering lands on the plateau above the village were excluded from the new reservation. The Havasupai, however, still retained the rights to traditional uses of non-reservation lands.

In 1944, the tribe was awarded four sections of released railroad land, which were exchanged for available state lands in the bottom of Cataract Canyon, 30 miles south of the present reservation. These 2,650 acres of land have poor access, no water and little agricultural or grazing potential.

The Havasupai Tribe's right to use non-reservation lands within Grand Canyon National Park was expressly recognized in the 1919 act establishing the park. Public Law 93-620 expanded the traditional use lands from 56,000 acres to 95,300 acres within the park. The Havasupai Reservation, outside the park boundaries, has been expanded to 185,000 acres.

Existing grazing use of lands within the park is described on page II-37. Future use will be determined by a study conducted by the Bureau of Indian Affairs, the Havasupai Tribal Council, and the National Park Service. Grazing is a proposed use for all suitable areas of the upland reservation and although grazing will take place on the Great Thumb mesa, the Havasupai have expressed their desire to maintain this area in its naturally productive condition (working draft of Havasupai Land Use Plan, October 30, 1975).

Preliminary resource actions proposed by the tribal council include restrictions on public hunting, providing a sanctuary for the desert

bighorn (hunting of this species would not be allowed), restoring certain native food plants, and adjusting game and livestock herd levels to the prevailing range conditions.

The Havasupai have long desired improvement in their economic and social conditions. Schools, medical facilities, and housing are primary concerns. The Havasupai have designated commercial, agricultural, and residential zones within the reservation. Development is to be low-density and homes would be rural-type or traditional dwellings. The Topocoba and Pasture Wash residential zones are located near the boundaries of the traditional use lands and Unit 5, respectively.

provisions will be made for visitor use of the reservation, including backcountry hiking, three wilderness camps, and additional overnight accommodations. Visitor use will be regulated to protect the natural resources and the activities and lifestyle of the Havasupai people.

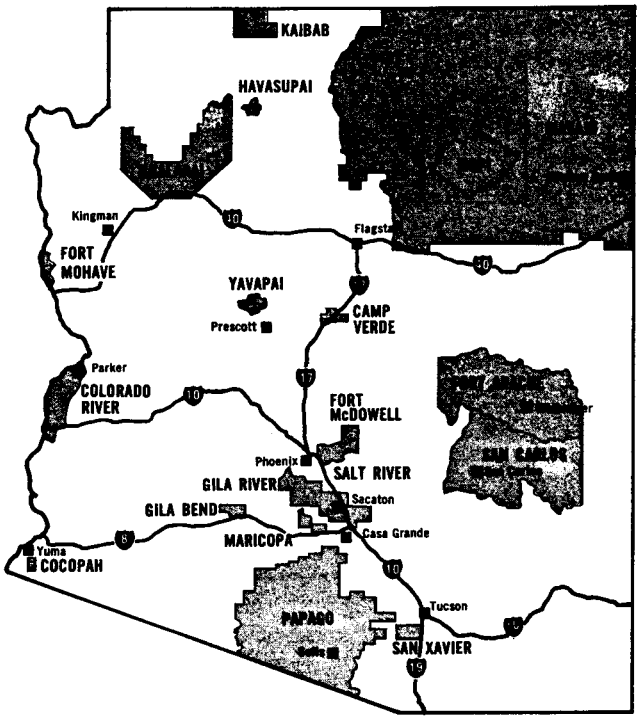
b. Hualapai Indian Reservation

The 900-member Hualapai Tribe occupies a 992,000-acre reservation in Coconino and Mojave Counties, Arizona. Their reservation is bounded on the north by the south bank of the Colorado River and on the east by the Havasupai Reservation and the western boundary of the South Rim Unit of Grand Canyon National Park. The major economic sector of the reservation is ranching. Four livestock associations and a tribal herd provide employment for 80 persons. Tourism and reactional activities are also major economic factors on the reservation. The reservation has both good hunting and fishing. The major conflict between this tribe and the wilderness proposal is their desire for the building of Bridge Canyon Dam. Although development of the dam is precluded without specific act of Congress, wilderness designation would impose an added restraint to the dam. The Hualapai also consider their northern boundary to be in the middle of the Colorado River rather than on its south shore. A solicitor's opinion is being sought on this issue. The location of the Hualapai and other Indian reservations in relation to Grand Canyon National Park are shown on page II-57.

c. Navajo Indian Reservation

The 9-million-acre reservation of the Navajo Nation abuts the park along the entirety of its eastern boundary and wilderness Units 3 and 4. A tribal park has been designated in this area along the Little Colorado River. The nearest heavy concentration of Indian residences to the park is at Cameron and Tuba City. The primary land use on the reservation next to the park is sheep grazing and the sale of native arts and crafts to tourists who stop at the overlook to the Little Colorado River along State Route 64. The Navajos are actively seeking to add 2.5 million acres of land in Houserock Valley to their reservation. If successful, this would place reservation lands along the west park boundary of Unit 3 in the Marble Canyon area.

INDIAN RESERVATIONS IN ARIZONA



Reservation and Tribe	County	Population	Area Acreage
AK-CHIN Papago	Pinal	266	21,840
CAMP VERDE Yavapai, Apache	Yavapai	346	640
COCOPAH Yuma	Yuma	360	1,411
COLORADO RIVER Mohave, Navajo Chemehuevi, Hopi	Yuma	1,581	268,691
FORT APACHE White Mountain Apache	Apache Gila Navajo	7,200	1,664,972
FORT McDOWELL Mohave, Apache Yavapai	Maricopa	340	24,680
GILA RIVER Maricopa	Maricopa Pinal	8,331	371,933
HAVASUPAI Havasupai	Coconino	363	3,077
HOPI Hopi	Coconino Navajo	6,567	2,472,254
HUALAPAI Hualapai	Mohave Coconino Yavapai	870	993,173
KAIBAB Paiute	Mohave	153	120,413
NAVAJO Navajo	Apache Navajo Coconino	71,396	8,969,248
PAPAGO Papago	Maricopa Pima Pinal	8,708	2,855,874
PAYSON Apache	Gila	65	85
SALT RIVER Pima, Maricopa	Maricopa	2,750	49,294
SAN CARLOS Apache	Gila Graham	5,097	1,827,501
YAVAPAI Yavapai	Yavapai	94	1,409

Note: Population figures represent the number of Indians on and near the reservation. The Navajo population is for Arizona only.

Source: 1975 Tribal Directory, Arizona Commission of Indian Affairs.

d. Federal Lands

The northern boundary of proposed wilderness Units 2 and 3 on the Kaibab Plateau lies against those of the Kaibab National Forest. These lands are managed under a multiple use concept - primarily for timbering, grazing, hunting, sightseeing and attendant camping or picnicking.

The rest of the northern boundary of proposed wilderness Unit 2 and the western boundary of Unit 3 along Marble Canyon lie against national resource lands managed by the Bureau of Land Management. The primary uses on these adjacent Federal lands are hunting and grazing.

e. Private Land Development

Vast expanses of the rural hinterland of the arid southwestern United States have been indiscriminately subdivided and sold without knowledge of the economic or physical capabilities of the environment to support the hundreds of thousands of new residents predicted in the promotional literature. Few developments have been truly successful, while the vast majority remain generally unoccupied and undeveloped. Developers typically seek extensive tracts of land of a low economic value that can be resold by promotional techniques for many times its purchase price. Private inholdings within the southern Grand Wash Cliffs portion of the park have been subdivided by various owners.

The lands surrounding Grand Canyon possess the amenities associated with a dry and warm climate, and many are now of relatively low economic value. Numerous promotional developments abound in northwestern Arizona some near, and some within, the western portions of the park, and three promotional land sale developments lie between Grand Canyon Village and Williams, Arizona. If paved highways are developed between I-40 and the southern boundary of the park and should Congress authorize the Hualapai Dam for construction, then promotional land sales and land developments can also be expected. With access, electricity and water relatively available, the land values would be expected to soar.

However, extensive development and occupation does not appear likely to occur. Land subdividers normally do not realistically consider the availability of basic services, vital utilities, employment opportunities, a functional economic base or any other such factors which are essential to sustain a permanent population. As a result, these subdivisions are often distinguished by a general absence of commercial, industrial or residential physical developments. Promotional developments of this type are normally marketed as investment property or for a retirement, recreational, or second home location. The support capability of the arid environment to maintain an urban standard of living for the massive influx of humans as advertised and projected in promotional literature is seldom sufficient.

These subdivisions are a striking feature on the arid landscape and the margin is very narrow between development and destruction of the physical environment. The rural subdividing process, as presently practiced, appears to be a destructive element in what could be an orderly and wise development of the land. Such developments cannot help but place substantive pressures and demands upon the wilderness resources within Grand Canyon National Park.

3. Visitor Use

Visits to National Park Service areas in the Grand Canyon region doubled during the decade of the 60's. Recent visitation to National Park Service areas in Arizona are given below.

TABLE 9

VISITS TO NATIONAL PARK

Areas Located Entirely in Arizona	1972	1973	1974
Casa Grande National Monument	117,500	135,100	98,200
Canyon De Chelly	503,200	565,900	498,000
Chiricahua National Monument	67,900	67,700	52,800
Coronado National Memorial	61,200	49,200	37,800
Fort Bowie	3,700	3,400	3,400
Grand Canyon	2,711,400	2,064,300	2,028,000
Hubbell Trading Post	71,700	72,100	73,600
Marble Canyon	11,100	12,700	11,100
Montezuma Castle	404,000	363,200	339,200
Navajo National Monument	119,100	120,000	110,600
Organ Pipe Cactus National Monument	86,600	89,400	105,000
Petrified Forest	1,229,000	1,072,000	789,200
Pipe Springs	33,500	24,100	19,100
Saguaro National Monument	219,100	309,800	363,800
Sunset Crater	280,100	239,700	203,800
Tonto National Monument	52,400	61,300	49,300
Tumacacori National Monument	68,400	78,200	71,000
Tuzigoot National Monument	88,700	87,900	80,600
Walnut Canyon National Monument	71,900	64,800	58,600
Wupatki National Monument	159,500	154,800	112,200
SUBTOTAL	6,465,000	5,635,600	5,107,300
Areas Located Partly in Arizona			
Lake Mead	4,888,600	5,534,300	5,939,500
Glen Canyon	970,900	1,209,100	1,158,200
TOTAL	12,324,500	12,379,000	12,205,000

Travel to Grand Canyon National Park has doubled in the last decade, and approached the 3 million mark in 1975, with a total visitation of 2,754,791. By the 1980's, it may easily reach the 4 million mark, causing increasing pressures on the wilderness resource of the park.

a. Developed Area Use

Most visitors to the Grand Canyon stay only a few hours, or just long enough to view the canyon from several points along the South and North Rim road systems - seeing but not entering the park's backcountry areas. During peak periods of travel, most visitors arrive and leave during daylight hours. Within the park are substantial overnight accommodations on the rims, capable of handling 3,500 people, and developed campgrounds with a total of 500 campsites.

Approximately 350 rooms are available at Moqui Lodge and at the village of Tusayan, just outside the south entrance to the park in the Kaibab National Forest. Camping sites are available 10 miles south of the park at the United States Forest Service's 10-X Campground. Several camper parking sites and campgrounds are being developed along Arizona 64, south of the park toward the city of Williams. Many visitors to the North Rim are accommodated at Forest Service campgrounds at Jacob Lake and DeMotte Park.

Motels and campgrounds at and near Flagstaff, Williams, and Jacob Lake, Arizona, can accommodate a sizeable number of visitors. Further expansion of the campgrounds outside the park can be expected in proportion to the demand. This is exemplified by a 300-site campground which is being considered for the Apex Siding area on the Santa Fe Railroad, just south of Grand Canyon Village and west of the village of Tusayan. Cameron and Gray Mountain, 60 miles to the east of the park, have modest overnight accommodations. Although the tourist-oriented towns of Flagstaff and Williams are only one to two hours' drive away from the park, hundreds of campers park overnight along roads leading into the park during peak periods of visitation.

The canyon proper is the heart of the national park, and it is the view of this natural spectacle which draws millions of visitors to the park each year. Present visitor use patterns show that a majority of park visitors view the canyon from the developed areas on both rims. These areas of development will remain focal points of visitation, and no new areas of rim or Inner Canyon development are called for in the Grand Canyon master plan (FES 75-97).

b. Backcountry Use

The undeveloped, backcountry portions of the rims and within the canyon have been traditionally managed as natural areas. A network of primitive,

fire and access roads are used for management access and by the solitude-seeking visitor to reach remote, backcountry rim areas. Access to the Inner Canyon below the rims is by foot, horse, or muleback, and by boat from Lees Ferry, Arizona. In 1975, more than 200,000 visitors entered the Inner Canyon by foot or muleback, 14,305 users entered the canyon by boat, and an estimated 50,000 saw the canyon from commercial, tourist air flights.

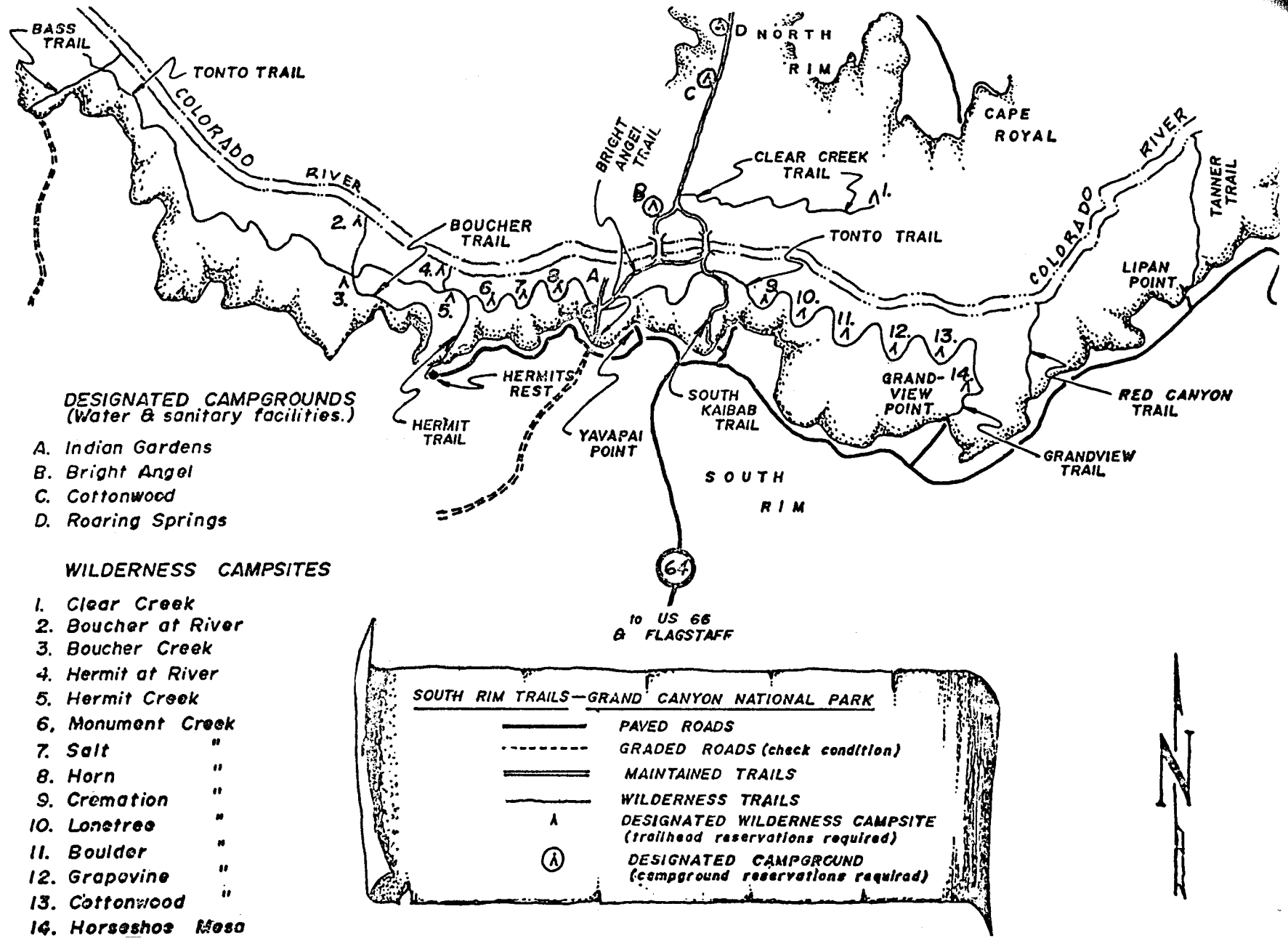
The vast majority of hikers and campers who enter the canyon use the trails and campgrounds situated along the Cross-Canyon Corridor between Bright Angel Point on the North Rim and Grand Canyon Village on the South Rim. The trails and campgrounds of the Inner Canyon are shown on page II-62. In 1975, camping along this corridor amounted to 12 percent of the total camping within the park, while other backcountry areas accounted for 6 percent of the total. Not counting visitors on river trips, the total amount of camping in the backcountry and Inner Canyon areas of the Grand Canyon in 1975 amounted to 75,000 camper/nights.

The protection and maintenance of natural conditions and a wilderness atmosphere have been paramount management objectives and practices on backcountry lands. Nothing in the way of human use has been permitted that would damage, impair, alter, or intrude upon the natural environment. Hiking trails are not maintained by motorized equipment. They are maintained only to those standards required for human safety. Wildfire is controlled as necessary to prevent unacceptable loss of wilderness values, loss of life, damage to property, and the spread of wildfire to lands outside the primitive areas. Motorized equipment is used in emergency situations involving the health and safety of persons, and to meet recognized management needs.

The backcountry trails within the Grand Canyon require a greater degree of stamina and expertise on the part of hikers and campers than do the trails between Grand Canyon Village and Bright Angel Point. Despite this fact, the demand for an Inner Canyon hiking and camping experience is increasing and recent restrictions placed on the overused portions of the canyon have simply shifted the ever-increasing demand onto the historic trails within the canyon. To protect the natural resources from overuse and deterioration, camping use has been placed under a reservation and permit system.

The reservation/permit system applies only to overnight hikers. There are no limits established or reservations or permits required for day hikers. Day hikers may register for their own safety at any ranger station. However, any hike involving technical climbing or caving must be authorized by qualified rangers prior to commencement of the activity.

The reservation/permit system is divided into two parts to cover a variety of backcountry areas and types of use. The two parts are the


BASS TRAIL
TONTO TRAIL
COLORADO RIVER
BOUCHER TRAIL
BRIGHT ANGEL TRAIL
NORTH RIM
CAPE ROYAL
CLEAR CREEK TRAIL
TONTO TRAIL
COLORADO RIVER
TANNER TRAIL
LIPAN POINT
HERMITS REST
HERMIT TRAIL
YAVAPAI POINT
SOUTH KAIBAB TRAIL
GRAND-VIEW POINT
RED CANYON TRAIL
GRANDVIEW TRAIL
SOUTH RIM
64
to US 66 & FLAGSTAFF
DESIGNATED CAMPGROUNDS
(Water & sanitary facilities.)
A. Indian Gardens
B. Bright Angel
C. Cottonwood
D. Roaring Springs
WILDERNESS CAMPSITES
1. Clear Creek
2. Boucher at River
3. Boucher Creek
4. Hermit at River
5. Hermit Creek
6. Monument Creek
7. Salt "
8. Horn "
9. Cremation "
10. Lonetree "
11. Boulder "
12. Grapevine "
13. Cottonwood "
14. Horseshoe Mesa
SOUTH RIM TRAILS—GRAND CANYON NATIONAL PARK
PAVED ROADS
GRADED ROADS (check condition)
MAINTAINED TRAILS
WILDERNESS TRAILS
DESIGNATED WILDERNESS CAMPSITE (trailhead reservations required)
DESIGNATED CAMPGROUND (campground reservations required)

Bright Angel-Kaibab Trails Corridor, and the backcountry trails (includes off-trail or cross-country hiking).

The maximum group size permitted to hike and camp together is 16 people. Any hiking party of 10 to 16 people is considered a "group." Two "groups" who are part of the same larger group or know the other group cannot occupy the same campground, since that would in effect be one group of more than 16 people. Each backcountry trailhead and campground has certain group restrictions which will be listed individually (Table 10).

Reservations in the corridor area, Bright Angel, North and South Kaibab Trails must be on a night-by-night basis for each campground in the corridor. Reservation requests specify the number of hikers in the party, the campgrounds to be used, and dates desired for each campground. All hikes in the corridor area are limited to a maximum of 8 nights per trip, with a limit of 2 nights, consecutive or nonconsecutive, in any one campground.

Prior hiking experience on the corridor trail system in Grand Canyon or similar desert areas is recommended for a permit on the backcountry trails or off-trail hikes. Backcountry trail reservations are made on a trailhead basis, rather than for each campground as on corridor trails. Backcountry trail reservations are made for the trailhead where and for the date the hike will begin. If more than one wilderness trail will be used, the reservation is necessary only for the initial trailhead.

Off-trail hiking in conjunction with backcountry trails is reserved under the initial backcountry trailhead for the date starting on that trail. Total off-trail hiking (involving no wilderness or corridor trails) needs no reservations, just a wilderness hiking permit. Any request involving extensive off-trail hiking, unusual routes, cave exploration or river crossings must be evaluated and authorized by a qualified Ranger.

TABLE 10

Desert View Zone	
Straight Canyon	16
Cedar Canyon	16
Divide	10
At-large	16
Cardenas Zone	
Grandview Trailhead	16
Hance Trailhead	16
Tanner Trailhead	16
Beamer (East End) Trailhead	16

Palisades Zone	
At-large	40
Pasture Wash Zone	
Bass	30
Havasupai Point	16
At-large	16
Bright Angel Zone	
Phantom Ranch	75
Cottonwood	40
Clear Creek Zone	
Clear Creek Trailhead	20
Garden Creek Zone	
Indian Gardens	75
Tonto Zone	
Bass Trailhead	16
Hermit-Waldron-Dripping Springs Trailhead	25
Tonto West Trailhead	20
Tonto East Trailhead	16
Boucher Trailhead	16
Apache Point Trailhead	16
Enfilade Point Trailhead	16
Walhalla Plateau and Widforss Point Zone	
Widforss Point	10
Tiyo Point	10
At-large	25
Kanabowits and Thompson Canyon Zones	
Point Sublime	20
At-large	40
North Kaibab Zone	
Roaring Springs	16
Powell and Nankoweap Zones	
Tapeats Creek	20
Deer Creek	16
Kanab Creek	16
At-large	16
Upper Tapeats Creek	
Surprise Valley	
Sandrocks	
Colorado River	

A Backcountry Use and Operations Plan has been prepared for Grand Canyon. This plan sets objectives for public use and the management of that use in all roadless areas within the park. The plan is almost exclusively directed at visitor use of backcountry areas of the park which are accessible by water, trail, or by primitive and not maintained roads.

c. River Use

The whitewater, wilderness experience of running the Colorado River through Grand Canyon National Park has become increasingly popular in recent years. In 1972, there were 89,000 passenger days (excluding crews) used by commercial boat operators, and 7,600 user-days used by private parties. This amounts to approximately 16,400 visitors who "ran" the river in 1972. Beginning in the 1973 season and extending through the 1977 season, the park's current interim River Management Plan will keep river use at or below this level. This plan proposed to scale river use toward an environmentally determined carrying capacity and to eliminate the use of motors on the river by 1977. The question of motor use has been deferred until a more comprehensive River Management Plan is completed. This plan will incorporate environmental research data gained from 1972-1976.

Beginning with the 1973 season, stricter standards of safety, sanitation, licensing, and interpretation were demanded of all commercial river operators. The maximum commercial passenger-days allotted each month is no greater than 25 percent of the operator's annual allotment. A maximum of 150 commercial passengers, and one party of up to 15 private users, is permitted to depart from Lees Ferry on any single day. The maximum number of commercial passengers per type of boat is 6 to 20, and the maximum number of passengers per commercial trip is 40 (averages 25). Commercial trips are not permitted to average more than 40 miles per day.

Commercial operators are being encouraged to begin conversion to oar operation. It is estimated that 20 percent of the trips in 1973 were oar-powered, and 25-30 percent in 1975.

After completion of the current research program on the river, ecological and sociological monitoring studies on the river will continue and be expanded both in scope and intensity under the park's Natural Resource Management Plan. Indications of environmental degradation will be cause for immediate cutbacks on an annual monthly or daily basis so that environmental qualities can be maintained to provide a quality wilderness experience for river users.

4. Access and Circulation

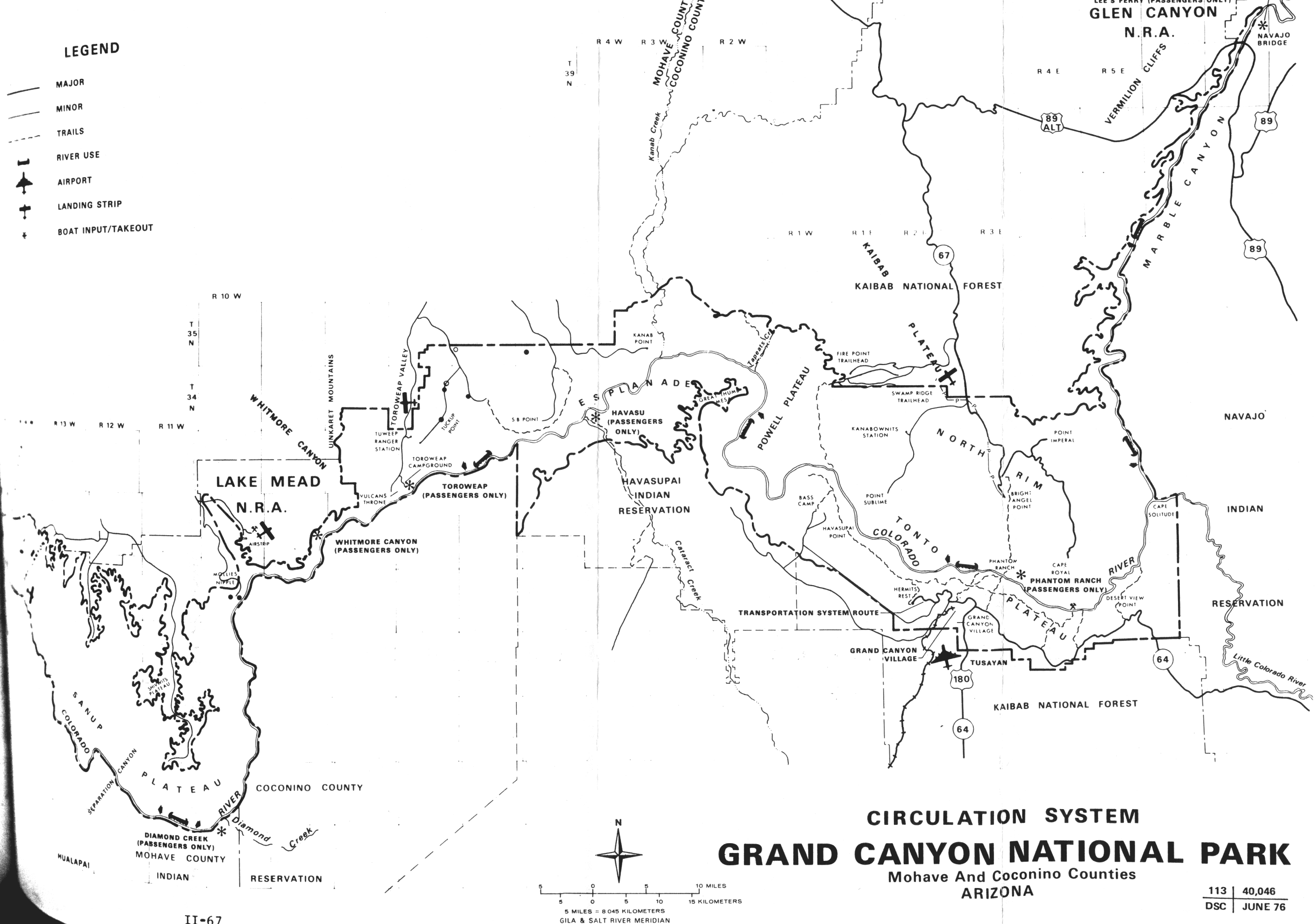
Vehicular access to Grand Canyon is provided by two-lane paved roads from the south (Arizona 64 and U.S. 180), from the east (Arizona 64),

and from the north (Arizona 67). The only vehicular access to the Tuweep area is over dirt roads. See map on page II-67 for access and circulation routes.

Public transportation services to Grand Canyon are limited. Bus service is available to Grand Canyon Village from Flagstaff and Williams, but the runs are infrequent - one or two runs per day. Bus service is available daily during the summer season to the North Rim from Cedar City, Utah. Air service is available from the Grand Canyon Airport just south of the park. Three main carriers provide service of 6 to 7 flights with connections to such points as Salt Lake City, Las Vegas, and Phoenix. Passenger rail service to Grand Canyon Village was discontinued by the Santa Fe Railroad in 1968. The resumption of such service, particularly in light of the energy shortage, may once again become economically feasible. The Saratoga Transportation Company of Phoenix, Arizona, has sought a contract with the Santa Fe Railroad to provide passenger service from Phoenix to Grand Canyon Village. The re-establishment of such service would require considerable and expensive roadbed work on the section of track between Williams, Arizona and the canyon, as the tracks are reportedly only safe for low speed travel.

Numerous road proposals are under consideration by the Arizona Department of Highways which may affect the wilderness of Grand Canyon National Park. In essence, these proposals would result in the park being encircled by paved highways only a few miles away from its boundaries. The road from near Peach Springs, Arizona to Hualapai Hilltop is currently being paved. This highway will give the members of the Havasupai Tribe an all-weather route to the trailhead 11 miles south of the village of Supai in Havasu Canyon. Future plans envision paving the Willaha Road, between Hualapai Hilltop and Arizona Route 64 south of the park. A paved link between Interstate 15 in the northwest corner of Arizona and Fredonia, Arizona has been proposed. A short paved road would lead south from this highway to the northern boundary of Grand Canyon National Park. A route linking U.S. 89 and U.S. 180 just north of the San Francisco Peaks has been considered for paving to provide a low-elevation, winter route from the South Rim to Flagstaff, Arizona and to provide a scenic loop drive around these strikingly beautiful volcanic peaks. A proposal for a county road linking Kingman, Arizona with Interstate Highway 15 via a bridge across Lake Mead at Pierce Ferry was revived in 1971 by the Mojave County Board of Supervisors. The implementation of this proposal would require a long and expensive bridge, and its economic feasibility remains uncertain. Priorities and funding have not been wholly committed on these projects at this time, and some may never be built. However, the construction of any or all of the roads must be looked forward to as a possibility of the future.

Easy access over paved highways to the boundaries of the park in areas presently protected by their isolation could lead to poaching and illegal encroachment by off-road vehicles. The nearness of paved highways will also bring demand from the private and business sectors to develop and increase visitor use in these currently backcountry areas.

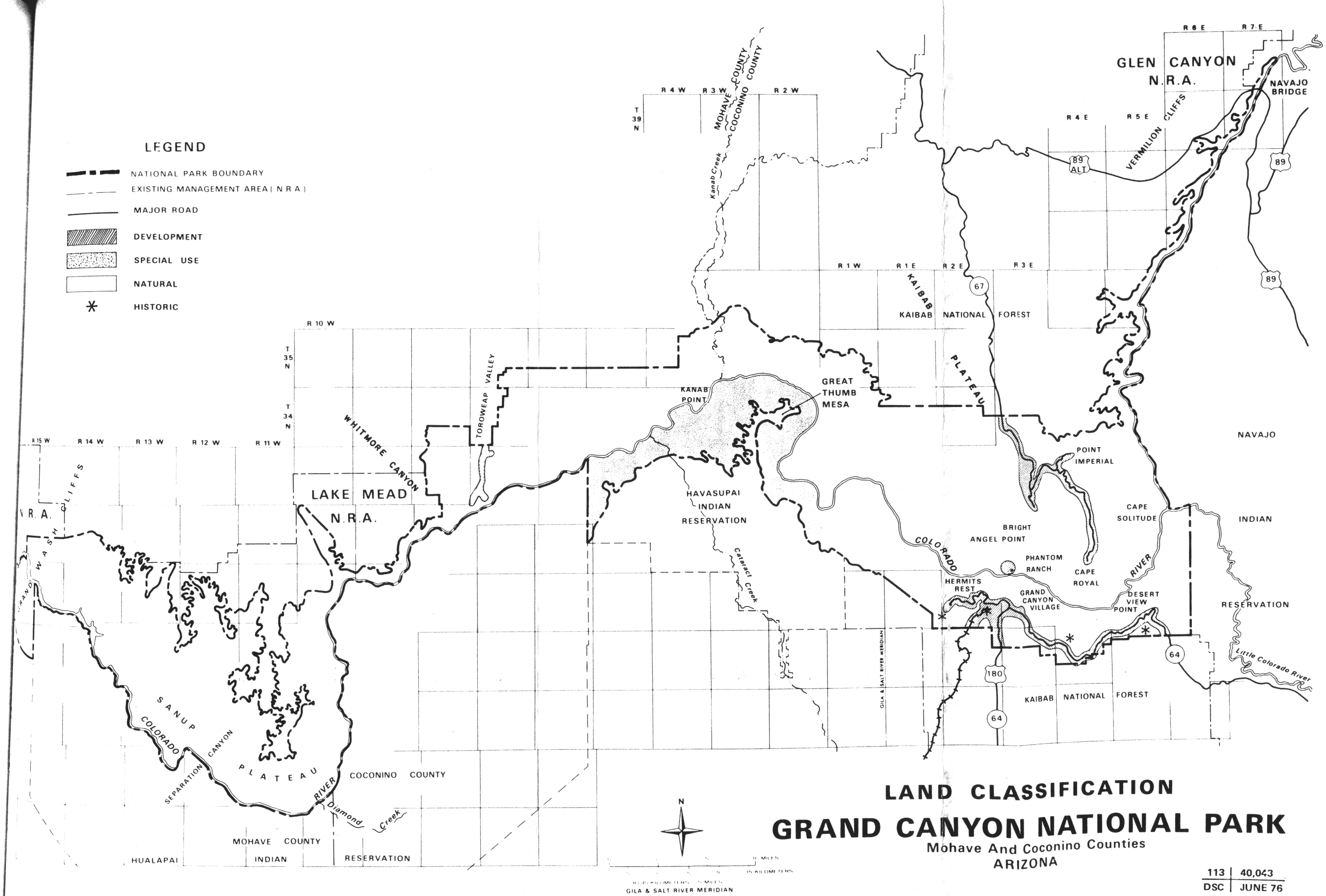


CIRCULATION SYSTEM

GRAND CANYON NATIONAL PARK

Mohave And Coconino Counties
ARIZONA

113	40,046
DSC	JUNE 76



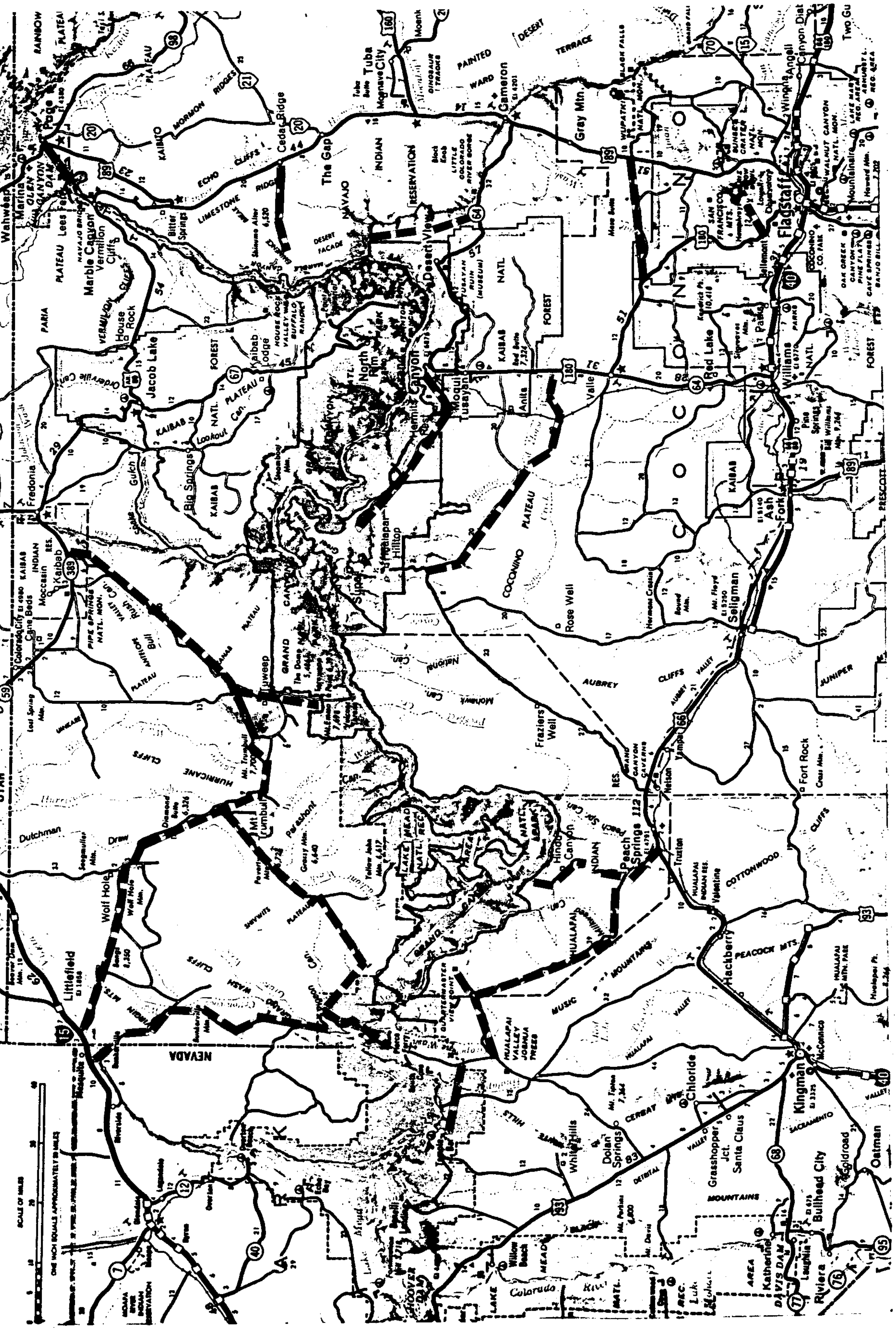
LAND CLASSIFICATION
GRAND CANYON NATIONAL PARK

Mohave And Coconino Counties
ARIZONA

113	40,043
DSC	JUNE 76

ROAD PAVING PROPOSALS

GRAND CANYON REGION



Most of the roads within the boundary of the park were established to facilitate grazing operations or, in the case of the North Rim, for fire control. Many of these roads were utilized for park purposes, providing access to backcountry areas. The park has recently completed an administrative road map that identifies road systems that will remain for management purposes. All roads not identified by management for retention have been included in wilderness. Roads required for mechanical access to maintain water catchments in grazing allotments have been identified as potential wilderness additions, until the grazing permits expire. Deleted roads will be returned to a natural state or utilized for trails.

N. LAND CLASSIFICATION

All lands within Grand Canyon have been subdivided three different ways: by land-use classification, by administrative management units, and by management zones. Administrative units are South Rim, North Rim, Inner Canyon, Desert View, and Tuweep. Management zones are based on topography, visitor use, access, natural and cultural features, administrative unit boundaries, and land classification.

Land classification is a prerequisite necessary to provide proper recognition and protection of the park's natural resources and to plan for visitor use and enjoyment of the values protected within the park. The land classification system used for Grand Canyon National Park divides the park into four major zones, as shown below.

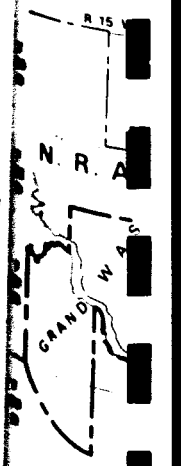
1. Natural Zone

Natural resources and processes remain largely unaltered by human activity, except for approved developments provided for use and appreciation of the park.

Wilderness Subzone: Lands and waters legislatively designated as wilderness, or those which are being considered for wilderness. They are managed to protect wilderness values in accordance with wilderness management policies.

Environmental Protection Subzone: Lands and waters possessing particular values as wildlife habitat and/or for research. They are managed to perpetuate ecological values without, or with minimal, human intrusion in accordance with the park resources management plan.

Outstanding Natural Feature Subzone: Geological and biological features possessing unusual intrinsic value or uniqueness. These features are often the park's principal attractions, and are managed to provide for visitor enjoyment without impairing resource quality.



Natural Environment Subzone: Natural environments not suitable or desirable for classification in other subzones which are managed to provide environmentally compatible recreational activities oriented toward the natural environment.

2. Historic Zone

Includes all lands containing resources listed on or eligible for the National Register of Historic Places, as well as other cultural sites worthy of protection and interpretation. Physical development shall be the minimum necessary to protect, preserve, and interpret cultural values. Activities permitted shall generally be limited to sightseeing and the study of cultural features, although adaptive use of historic structures for utilitarian purposes is also permitted.

In most cases, boundaries shall be identical with those of properties nominated to the National Register, and shall include sufficient land for the protection and public appreciation of cultural resources and their settings. Any reclassification or partial reclassification of existing historic zones or alienation of historic zone land shall require compliance with the Procedures for the Protection of Historic and Cultural Properties promulgated by the Advisory Council on Historic Preservation under the National Historic Preservation Act of 1966 and Executive Order 11593 (36 CFR Part 800).

3. Development Zone

Includes lands and waters where nonhistoric park development and intensive use, existing and proposed, do or may substantially alter the natural environment. Managed to provide and maintain development that serves the needs of park management and relatively large numbers of visitors. Aggregations of buildings, parking lots, service roads, and utilities are included in this zone which shall be restricted to the smallest area necessary to accommodate existing or proposed development and use.

Roads extending beyond a development center will be included in the natural, historic, or special use zone through which they pass. Developments permitted in other zones do not constitute classification as a development zone.

4. Special Use Zone

Special uses of the lands and waters not suitable in natural, historic, or development zones are included in this category. Examples of lands placed in the special use zone would be privately owned lands within the authorized park boundary and lands such as the Little Orphan Mine, where removal of a nonrenewable resource is legally sanctioned. Management will be as is appropriate or specific to the particular situation.

O. PROBABLE FUTURE OF THE ENVIRONMENT WITHOUT THE PROPOSAL

Without formal wilderness designation, the proposed wilderness areas in the park would continue to be managed for their natural values and for primitive backcountry uses such as hiking and camping. Existing trends in land use would probably continue. Public use in developed areas of the park will increase and pressures will be brought more effectively upon the planning process to accommodate more intensive recreational use and associated facilities in the natural areas of the park. Private interests could also more effectively bring pressure upon the park to re-establish grazing as a valid use on natural areas of the park now being proposed for wilderness. In short, it would become progressively more difficult to preserve the unconfined primitive nature of the back-country areas of the park as well as the atmosphere of solitude which the Wilderness Act intends.

III. ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

In any action which designates a specific land use, there is always the implied impact of the loss of all excluded uses and management practices even if these uses are only potential. If the designated land use does not alter the physical environment, then potential uses are not truly lost, but only prohibited by legislation. Such prohibitive legislation may be reversed should Congress deem it necessary for the national well-being.

Provisions in the enabling and ensuing legislation for Grand Canyon National Park through 1975 provide for certain types of land use within the park. Types of land use for natural areas are also provided for in the management policies of the National Park Service as revised in 1975. These land use provisions indicate that wilderness status for the lands described in this statement will cause little substantive change or have immediate effect upon land use or upon the natural and cultural environment.

A. IMPACT ON NATURAL RESOURCES

1. Mineral Resources

As outlined under Description of the Environment, the potential for fuel and mineral resources within the park is low. The low tenor of ore bodies, small size of deposits, difficulty of access, and lack of water prohibit the economic withdrawal of the known mineral resources in Grand Canyon National Park. Prospecting, claiming, leasing, and extraction are prohibited upon Federal lands within the park and wilderness designation will have no effect upon this prohibition. There are no private lands with mineral resources which will be denied access by wilderness designation. Acquisition of existing valid claims and reserved mineral rights will be accomplished whether or not the lands receive wilderness status.

Extensive developments will not occur on lands designated as wilderness and thus the soil disturbance, bedrock excavation, and erosion potential associated with such developments will likewise not occur. Upland modifications of lands north of the Tuweep District and the Sanup Plateau by private parties or other agencies could affect downstream areas within the park's wilderness. Such modifications could result from chaining operations, overgrazing, water catchments and check dams, or mining and oil well drilling operations. Increased erosion, siltation, or pollution of water in the wilderness could result from such actions outside of the park. The threat of these effects is felt to be minor under the current land use practices on adjacent lands.

2. Hydroelectric Potential

The Grand Canyon Enlargement Act of 1975 (Public Law 93-620) did not affect the status of hydroelectric potential on the Colorado River. The act of February 26, 1919, which established Grand Canyon National Park, was amended to authorize the Secretary of the Interior to permit utilization of those areas formerly within the Lake Mead National Recreation Area for the development and maintenance of a Government reclamation project. However, Section 605 of Public Law 90-537 (approved September 30, 1968), provides that Part I of the Federal Power Act shall not apply to the portions of the Colorado River between Hoover Dam and Glen Canyon Dam unless otherwise provided by Congress. Public Law 90-537 precludes the Federal Power Commission from licensing, construction or operation of non-Federal hydroelectric power developments in the same area, which includes all of the Grand Canyon National Park.

The effect of Public Law 90-537 is to preclude construction of hydroelectric dams in the Grand Canyon without specific consent of Congress. Public Law 93-620 does not change this provision and specifically states in Section 9 that "Nothing in this Act shall be construed to alter, amend, repeal, modify, or be in conflict with the provisions of Sections 601 to 606 of the Colorado River Basin Project Act, approved September 30, 1968." As a result, the repeal of Section 9(b) of Public Law 93-620 would have no impact on future hydroelectric dam construction in the area affected by the proposed wilderness, as Congress currently prohibits licensing of such projects. Repeal of Section 9(b) would have no effect on minor reclamation projects as the Bureau of Reclamation indicates that none are proposed within the lands added to the park.

Non-utilization of the hydroelectric potential of the Colorado River as it flows through the Grand Canyon is an irreversible impact only in the sense that the power that could be generated from it is not utilized at this point in time and at this specific geographic location. As long as the hydrologic cycle continues to function and as long as the Colorado River is allowed to flow into the canyon, the potential for hydroelectric generation exists. Should Congress decide that the national need to consume energy is greater than the national need for this national park to remain in a natural and unimpaired state, then the Grand Canyon could be utilized as an energy resource.

Should the Congress of the United States so decide, then the permanent, long-term adverse environmental impacts of proposed dams and their benefits to the human environment would be properly weighed in the appropriate impact statements which would be required and subject to public scrutiny. Wilderness areas would therefore presumably be used

for reclamation purposes only in cases where the agency could show that no feasible alternative is available that would eliminate or substantially reduce adverse effects on the wilderness environment. As the physical resource remains untouched under wilderness status, its potential use as an energy producer remains unaffected - only its current legal land status is affected.

3. Environmental Quality

Wilderness designation will greatly facilitate compliance with Executive Order 11752, which requires adherence to air- and water-quality standards in accordance with the Clean Air Act of 1970, the Federal Water Pollution Control Act of 1970, and applicable state regulations. Noise level standards will also be more acceptable on lands designated as wilderness. The use of motor vehicles in the backcountry will be eliminated and aircraft landings severely curtailed and limited to emergency and administrative purposes.

At the present time there are 16 commercial firms which provide scenic flights over the Grand Canyon by both fixed-wing and helicopter. The flights operate at varying altitudes, both above and below the canyon rims, but no landings are permitted within the park except for emergency purposes. Wilderness designation will not preclude the continued operation of these flights. Commercial and private overflights of the canyon can number one to two hundred per day during the summer months. Cooperative agreements with flight operators over the past few years have resulted in rerouting of flights to lessen the visual and audible impacts of these flights over areas of visitor concentration. Wilderness designation will lead to increased pressure to remove the impact of overflights from wilderness areas by rerouting or altitude restrictions which may cause the flights to resume their previous routes over heavily visited areas.

Air, water, and noise pollution created by the construction of additional developments in natural areas of the park will be eliminated by the preclusion of these developments under wilderness designation.

Noise, water, and air pollution are all concomitant with the operation of motor-powered boats on the Colorado River. If the river attains the status of wilderness, these environmental impacts will be eliminated. If the river remains in potential wilderness or in its present natural area designation, the motor use will continue and designated wilderness areas within the Inner Canyon will be affected by the sound and air pollution of the motors.

4. Biotic Resources

Wilderness designation will affect the management of wildlife and vegetation by restricting the use of motorized equipment and methods that might be the most effective but are not the minimal techniques required in wilderness areas. Control of feral animals such as burros and various exotic

plants that threaten the ecological stability of some areas may be rendered less efficient under the strictures of wilderness status.

The prevalence of forest insects and diseases and the consumption of the natural resources by fire will be unaffected by the proposed action. Endemic infestations and wildfires that threaten important resources or which threaten to impact adjacent private and public lands can be controll under the provisions of the Wilderness Act, subject only to any Secretaria limitations imposed. Controlled burning and other management practices, which do not require the use of motorized vehicles, will continue on wilderness designated lands. These practices are designed to protect the wilderness ecosystems from destruction and, where possible, to return areas to a more natural state. Mule deer habitat will be improved, as well as that for other species of mammals and birds. Wilderness designation does not preclude resource management practices that allow natural occurrence of wildfire or insects to have their natural effects on the ecosystem.

Administrative road closures within designated wilderness areas will inhibit illegal off-road vehicular use which is particularly damaging to the meadows on the North Rim. Once closed, many of the management roads on the North Rim which traverse meadows can be brought to grade and the unnatural vegetation and ground water break provided by the roadway eliminated. This will re-establish the natural ecosystem in these areas and have the effect of maintaining both the meadows and the surrounding forest at their natural boundaries.

The presence of domestic livestock legally grazing on Units 1 and 2 will continue to lower wilderness values through the next 10 years. Grazing livestock alter the natural environment by trampling, vegetation damage and consumption, and by selective foraging which alters natural species compositions. Domestic livestock disturb the normal breeding habits of some wildlife and compete for food, water and habitat with others. Desert bighorn populations are particularly sensitive to disturbance from cattle-induced competition. Water catchments developed for domestic livestock are utilized by wildlife and distort normal population patterns.

If optimum wilderness values are to be derived from wilderness designation, exotic plants, trespass livestock, feral and exotic animals within the park will be affected by control measures or elimination. Exterior boundary fencing will be required to exclude domestic livestock and feral horses and burros from wilderness wildlife habitats. This fencing will not only eliminate trespass grazing and competition, but will also allow for the slow natural repair of overgrazed rangelands, improve wildlife habitat, and re-establish the natural ratio between browse and non-browse species of plants. Vegetation types not subject to grazing would benefit from wilderness designation to the extent that

wilderness status prevents their destruction due to vehicle use, construction activities, and trampling by large numbers of visitors.

The park's master plan contains resource management objectives that should provide plant and animal populations a greater opportunity for survival. Wilderness designation, with its required management mandates, is compatible with the resource management objectives for the park. Preservation of wilderness in a natural state will protect the vitality of native species and help perpetuate endangered and threatened species that inhabit the park.

B. IMPACT ON CULTURAL RESOURCES

The Grandview Mine on Horseshoe Mesa in Unit 3 is the only property on the National Register of Historic Places which is in an area affected by this wilderness proposal. Wilderness designation for the lands surrounding this site will give the site and its historic setting further protection from modern inroads such as developed campsites and highly maintained trails.

Wilderness designation will affect archeological resources in preventing possible destruction of archeological remains as a result of construction activities and by limiting types of visitor activities in wilderness areas. Road closures will reduce the activities of illegal pot-hunters entering the park from the Arizona Strip.

C. IMPACT ON SOCIOECONOMIC FACTORS

1. Visitor Use

The backcountry use of most of Grand Canyon National Park is light and has not been quantitatively evaluated. The severe desert environment of the Inner Canyon and rugged terrain have limited use to the hardy. The spectacular wilderness areas in this proposal have been largely unheralded and unappreciated by the public at large. The establishment of wilderness in the park will focus public attention on these areas and may result in increased backcountry use, especially during the moderate seasons of spring and autumn. Restrictions on overnight use of the recommended lands are already in effect, and are expected to continue regardless of the decision concerning wilderness designation. Since present access to the proposed lands is limited to hikers, mule riders, and boat passengers along the Colorado River, it is possible that some individuals interested in these activities will seek alternative opportunities elsewhere. This may affect adjacent lands administered by several Indian tribes, the Bureau of Land Management and the Forest Service where limited opportunities for hiking or riding below the canyon rim are available. It is anticipated that restrictions against overuse within wilderness areas in the park will not create a serious overflow of recreation seekers onto adjacent lands.

The growth of the backcountry camping industry in this country shows no signs of abatement. Increased wilderness use will further stimulate this industry and wilderness units at Grand Canyon National Park will play a part in this.

All mechanized forms of transportation, except to protect human life and safety or to protect wilderness resources, are prohibited in wilderness areas. Therefore, those preferring this type of outdoor experience will have to practice it elsewhere. The exclusion of motorized vehicles will be even more rigidly enforced under wilderness classification than under the present classification.

There will be no effect on visitor access into the backcountry, as trailheads are being retained in the wilderness proposal. Viewpoints in the developed portions of the park offer opportunities for the motorized park visitor to enjoy vistas of the wilderness with no impact on the wilderness. The preservation of this key attraction in an undisturbed wilderness state can only be viewed as a beneficial impact upon the human environment of the park visitor.

There are no known hazards to public health and safety that will be increased or decreased as a result of the proposal. The Wilderness Act provides for those emergency measures required to protect the health and safety of persons within a wilderness area. The proposal could entail slightly increased risk of man-caused wildfires, if formal wilderness designation results in increased public use of the backcountry.

2. Land Use

There will be little effect on grazing as it currently occurs within the park because all non-lifetime permits will be eliminated by 1985 regardless of the establishment of wilderness areas. Grazing on the Havasupai Traditional Use lands will not be affected by the proposed action.

The major impact of wilderness designation on grazing will be the restriction against using motorized equipment to maintain range improvements such as water catchments. The rugged terrain and low productivity of appropriate forage in most areas impedes efficiency of cattle-raising operations. The movement of cattle is restricted and vehicular access to rangelands is presently difficult or impossible. The emplacement of fencing, watering devices, and related support facilities is likewise difficult, expensive, and seldom done. Horses may be substituted for motor vehicles, as most grazing areas are no more than a few miles from jeep trails or trailheads outside of the wilderness.

Some minor amounts of hunting occurred on lands added to the park by the Grand Canyon Enlargement Act of 1975. Hunting was prohibited with

incorporation and wilderness designation will have no additional effect upon it.

In proposed wilderness Unit 2 the national resource lands lying above 6,000 feet on Slide Mountain and Mount Emma are considered to be a critical summer range for portions of the Mount Trumbull deer herd by the Bureau of Land Management. The Bureau's game management program typically includes such activities as chaining, prescribed burning, and water tank development to increase deer populations for harvest. Wilderness designation on adjacent park lands will have the effect of removing such habitat manipulation as a management option, underscoring the policy of preserving wildlife as a component of the natural ecosystem within a national park.

3. Indian Reservation

No effect is foreseen in the status of or in the social, economic, or environmental status of the Navajo, Havasupai, or Hualapai Reservations because of wilderness designation in the park. The proposed action will not conflict with existing water rights, as there will be no increase in water consumption, and the proposed wilderness boundary will not alter the Indian's existing access to the use of the Colorado River. Tribal grazing privileges, boundary rights, and religious uses of the land have been considered throughout the planning for the wilderness proposal. Limitations on development in the proposed wilderness could provide increased opportunity for development on Indian lands adjacent to the park, should the various tribes involved decide that such development is desirable.

D. IMPACT ON PARK MANAGEMENT

One of the major implications of wilderness designation is the prohibition of the future development of roads and facilities. This prohibition protects natural resources from the effects of construction and operation of facilities. Because the majority of the land recommended for wilderness is not economically suitable for development, the impact of wilderness designation should be minimal. The shortage of an economical, dependable water source, the sparse vegetation, and harsh climate, combined with limited access and the shortage of sites suitable for construction all preclude significant development of these lands regardless of their legal classification. This factor is recognized in the park's master plan.

The option for nonwilderness administration, development and management of these lands will be foregone under the wilderness proposal. However, by the fact of the proposal, the National Park Service considers this loss of option to administrative action to be for the best use of the

land and to have a minimal impact on present land use policy. Management costs will increase because of wilderness limitation and the need to more strictly limit the amount and type of visitor use in wilderness areas.

A limited impact may result from increased costs of archeological studies, owing to the limitations on mechanized access. However, where no other means of transportation is feasible, it is within the prerogative of wilderness management to permit the use of helicopters for scientific or management support. With adequate justifications, archeological excavations are permitted within wilderness areas.

Wilderness restrictions may also impair the efficient conduct of potential research on natural as well as archeological resources. The wilderness proposal will retain vehicular access to selected trailheads for wilderness hikers, and researchers should be able to reach most research areas by hiking or horseback from these trailheads. The prohibition of permanent research stations and facilities within wilderness areas may be a greater impact upon efficient research than restriction of access. In many instances these research facilities could be located immediately adjacent to wilderness units; however, if wilderness designation limits the ability of scientists to acquire knowledge about the park's natural resources, then the management of these resources will be done on the basis of more limited factual information and increase the probability of erroneous decisions and actions.

Research studies and data collection involving no permanent installations or mechanical equipment are allowed under wilderness designation. Temporary devices for gathering hydrologic or climatological data, water quality monitoring, and gaging water flow would be accessible by boat, foot, or horseback. The present gaging station operated by the U.S. Geological Survey at Phantom Ranch would not be affected as it is located outside the proposed wilderness areas.

The ability of the park staff to patrol the wilderness areas would be reduced to a small degree due to the closure of backcountry roads. After wilderness is established, possible increased use of the backcountry may require more patrols to protect archeological and certain natural resources from vandalism. This patrolling would be almost impossible, except from the air, in the remote areas of Unit 2, which contain many known, and probably more unknown, archeological resources. The probability of damage to these resources from visitor activities is low, but most likely in this area.

E. IMPACT ON WILDERNESS VALUES

The lands being considered for wilderness designation in this proposal are all now being managed as natural areas. There is a value difference

implied between the two types of designation and the effects of wilderness status will be to magnify and embellish certain impacts and to seemingly create others from this value difference.

The effects of increased visitation that are expected from the simple change in designation were mentioned under Visitor Use impacts. The effects of outside influences and actions such as chaining, animal poisoning, poaching, livestock trespass, illegal mining, pothunting, clear-cutting, road improvements, air quality degradation and the like, all have more significance when pertaining to wilderness rather than natural area lands.

There are no visitor-use facilities or developments within the proposed wilderness to detract from wilderness values. There are minor developments such as fencing, water catchments, water tanks, and corrals within the proposed wilderness which are used in the present grazing operations. The areas impacted by these uses will be returned to a natural condition following expiration of the grazing permits and will have little impact on wilderness values.

Ladders, cables, two water tanks, and two tramway towers remain as evidence of the past guano mining activity at Bat Cave. These will be evaluated for historic significance, and if found to lack historic importance, will be removed from wilderness Unit 2, as will the obsolete fire tower at Kanabowits Station, and will have no further impact upon wilderness values.

Other ruins and sites being evaluated for their historic content in the proposed wilderness areas are small and widely scattered - largely unnoticeable as the works of man in the vastness of the Grand Canyon backcountry.

Wilderness values will be diluted along boundary lines adjacent to heavily used nonwilderness areas such as the cross-canyon corridor and along roadways.

IV. MITIGATING MEASURES INCLUDED IN THE PROPOSAL

Information will be provided to wilderness visitors about trails, water sources, campsites, and possible problems associated with wilderness travel. Wilderness designation will help control use of these portions of the park where the environment can present a hazard to the inexperienced or uninformed. Both resource protection and visitor safety will be insured through properly oriented educational and interpretive programs.

Use limitations, carrying capacities, and registration for hiking and camping have been established for the areas under consideration for wilderness designation. A Backcountry Use and Operations Plan has been prepared and the River Management Plan is currently being revised for the park. Carrying capacities and use limitations are designed to preserve wilderness values and will be strengthened or modified only as a result of sound ecological research findings.

Backcountry management actions will adhere to strict ecological and esthetic standards by utilizing the minimum tool or means available to provide for visitor safety.

There is currently no use of lands adjacent to those proposed for wilderness which is prohibitively incompatible or intrusive upon the wilderness areas. The National Park Service will cooperate with the other Federal land management agencies in the region and with the local Indian tribes in the coordinated efforts, studies, and planning required to preserve wilderness continuity on adjacent lands, mitigate impacts from non-wilderness lands, and to provide for the accommodation of any overflow recreation demands created by wilderness use limitations.

The National Park Service, the Northern Arizona Council of Governments, and other concerned agencies within the jurisdiction of the Arizona State Clearinghouse will continue to conduct meetings to resolve the problem of accommodating potential visitor growth in surrounding communities. Visitor limits in developed areas as well as any future restrictions in the proposed wilderness units could create undue burdens upon local services and facilities. If new facilities are properly planned and located on an areawide basis, surrounding cities and communities could realize economic benefits. To this end, the National Park Service will cooperate with state and local entities whose primary concern is sound regional planning.

For visitors who are unable or unwilling to hike into the wilderness, commercial river trips will continue to provide access through the center of the Inner Canyon wilderness. Additional access to the fringes of the wilderness is available by mule rides in the Cross-Canyon Corridor. Each of these activities allows the non-hiker to visit portions of the

canyon similar to, but less primitive than, those areas proposed for wilderness designation. The heart of the canyon, the Colorado River and the Inner Gorge have not been reserved for the exclusive use of the hiker and the backpacker.

River and backcountry use limitations proposed in the master plan and the regulation of the method of disposal of human wastes will aid in preventing contamination and pollutive materials from entering the park's naturally occurring waters and endangering wilderness users. Users will also be advised of the water quality in the backcountry and informed of appropriate water treatment methods.

Although not specifically recommended in the wilderness proposal as a mitigating measure, research provides factual information on park resources that provides an objective basis for decisionmaking. Research, therefore, facilitates the implementation of management actions that will result in greater protection for, or reduce the adverse effects of use on, natural and cultural resources.

Scientific studies will continue to be permitted on both wilderness and non-wilderness lands within Grand Canyon National Park. The ongoing ecological and sociological studies on the river will be reduced both in scope and in intensity, but follow-up studies and monitoring will continue. Research data gathered during each season will be analyzed and evaluated so that visitor use quotas for the coming season can be established by mid-September each year. Evidence of environmental degradation will be cause for immediate cutbacks on an annual, monthly, or daily basis so that environmental and wilderness values can be maintained, providing a quality wilderness experience for the river users.

Pursuant to Public Law 93-620, Section 7, efforts will continue to be made to reduce the adverse effects of any aircraft or helicopter activity on the natural quiet and experience of the park visitor. River-running concessioners will be encouraged to phase in the use of oars to enhance the wilderness experience for both river runners and wilderness hikers near the river.

Endemic infestations of forest insects or diseases and wildfires that threaten an unacceptable loss of wilderness values, loss of life, damage of property, or which threaten to spread to adjacent public or private lands, will be controlled under the provisions of the Wilderness Act of 1964, subject only to any Secretarial limitations imposed. Boundary fencing and posting will mitigate to some degree the influx of trespass livestock, feral animals, poachers and pothunters into the park's wilderness areas.

A comprehensive archeological overview and a study of the park's historic resources are planned and will be accomplished when funding becomes

available. Sites of archeological and historic importance will be evaluated and nominated to the National Register of Historic Places.

In compliance with Section 2(b) of Executive Order 11593, the National Park Service is exercising caution until inventories and evaluations are completed, to insure that no cultural sites of potential national significance are altered or destroyed. The wilderness proposal will not result in the transfer, sale, or demolition of any potential National Register property.

The State Historic Preservation Officer for Arizona will receive copies of this draft statement for review, and his comments will be incorporated into the final environmental statement.

Coordination and cooperation in planning will be maintained on a continuing basis between the National Park Service, surrounding land management agencies, Indian tribes, state and Federal agencies, and regional planning organizations to insure that all projects in the region entail a minimum adverse effect on wilderness areas within the region.

V. ANY ADVERSE EFFECTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED

The publicity surrounding the establishment of a wilderness may result in a more rapid increase in visitor use than if the lands remained in their present status. Visitor use limitations have already been placed on these areas to prevent overuse and abuse. Increasing use of the area may result in the need for additional limitations. This restriction on visitor use of public lands could be regarded as an adverse social impact.

At some time in the future, it is possible that there will be overflow recreation needs onto surrounding land areas caused by restrictions on type and amount of use in wilderness designated areas. This is unavoidable and is expected to be numerically insignificant compared to the present recreation demands on these surrounding areas.

The existing policy of prohibiting mechanized access to the recommended lands would be continued if the wilderness proposal is approved. Although this would not represent a change in the present situation, the prohibition would not be subject to administrative change as is the case at the present time. Some persons could view such limitations as an adverse social impact.

The increased costs to management of the areas designated as wilderness will be unavoidable because of management limitations imposed by the Wilderness Act, and the need to more strictly limit the amount and type of visitor use in wilderness areas. The costs are expected to be low but significant in the park budget.

Some impairment of potential future research, due to restrictions on the use of motor vehicles and mechanized equipment and restriction on the establishment of permanent research facilities, is probably unavoidable. Such impairment would likely be most significant with respect to the conduct of archeological or paleontological inventories in rugged and inaccessible backcountry areas, such as the Sanup Plateau region.

VI. THE RELATIONSHIP BETWEEN LOCAL, SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The designation of wilderness areas in Grand Canyon National Park commits the National Park Service to a management policy that will perpetuate an atmosphere of wilderness solitude, as well as facilitate the protection of ecological stability and the integrity of cultural resources. The short-term economic productivity of wilderness areas for consumptive or disruptive uses of resources will be impaired in order to preserve wilderness values. Wilderness designation, by definition, is an action that is long-range in nature and precludes short-term consumptive use of the resources represented therein.

Maintenance of the wilderness as a preserve managed according to existing antiquities legislation and National Park Service policy and activity standards for historical and archeological resources will continue to insure optimum, long-range preservation of archeological and historical resources.

Most wilderness values are irreplaceable environmental resources. As the number of outstanding natural areas becomes reduced across the nation, the values of the wilderness resources remaining will progressively increase in their subjective benefits to man. The preservation of the unique combination of scenic, biotic, geologic, and historic values in the areas proposed for wilderness in the Grand Canyon is a long-term gain for the environment and for future generations of Americans.

VII. ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

There are no natural or cultural resources irreversibly or irretrievably committed to destruction or consumptive use by this proposal. All uses excluded by national park and wilderness status are retrievable should the land status be changed at some future time. If it is determined to be desirable for the national well-being, Congress can dis-establish a national park or wilderness area and give it any status deemed appropriate. The potential for utilizing the resources of these lands for such visitor use facilities as hotels, roads, restaurants, and curio shops is foregone only so long as the land's wilderness classification is not changed.

Potential economic losses to private interests involved in grazing may occur as a result of restrictions on access to wilderness areas. Public pressure to perpetuate a high-quality, unpolluted wilderness environment free from the disturbance of incompatible uses, will be exerted, and may result in irretrievable loss of potential economic benefit from projects entailing consumptive resource use.

While current and future use is primarily for social and educational purposes of the general public, its commitment to wilderness can be reversed at some future time by Federal legislative action, should the consumptive use of the resources be deemed necessary for the well-being of the nation.

VIII. ALTERNATIVES TO THE PROPOSED ACTION

A. NO ACTION

1. Description of No Action

If no wilderness is designated in Grand Canyon National Park, the proposed wilderness area would continue to be managed as primitive backcountry, which is essentially the same use and management specified under the Wilderness Act of 1964. However, lack of Congressionally designated wilderness would entail several potentially significant environmental impacts.

2. Impacts of No Action

If no action is taken, administrative reclassification of existing primitive lands would be possible. Such reclassification would allow for more intensive recreational use and development, thereby jeopardizing the atmosphere of wilderness solitude that these lands now possess. Construction of new roads and the resultant incursion of vehicles in existing primitive areas could take place, subject only to administrative approval by the National Park Service and the Department of the Interior. Increasing levels of noise, air pollution, and disruption of wildlife behavior patterns would result.

Failure to establish legislative wilderness areas would permit greater flexibility in management techniques, which could result in reduced management costs. These techniques might include use of motorized maintenance equipment, as well as the construction of more elaborate and efficient waste-disposal systems than would be permitted in wilderness areas. The efficient conduct of research in remote backcountry areas - particularly archeological and paleontological surveys - would not be impeded by restrictions on the use of vehicles and various types of equipment and the establishment of relatively permanent research facilities.

Public pressure to disallow incompatible uses could not be brought to bear on proposed Federal actions as effectively in a primitive area as in a wilderness area. Even though grazing, reclamation operations, and power projects may be permitted in wilderness areas, it is unlikely that these uses will be begun in wilderness without full public disclosure and public involvement in the decisionmaking process.

Although no plans for development facilities in any of the proposed wilderness areas have been formulated, without legislative wilderness designation such development is not precluded. The construction of additional facilities in existing primitive areas as a result of increased demand might result in: increased damage to vegetation from off-road

vehicle use and trampling; reduction in the opportunities for solitude due to increased visitor density in backcountry areas; reduction in usable habitat for desert bighorn and other wildlife species that require large amounts of range free from human influence; and a gradual erosion of the opportunity to manage Grand Canyon National Park to accommodate an unconfined backcountry experience.

There is some evidence that the formal designation of wilderness areas tends to increase their use. It is impossible to determine at this time whether the increased use is short-term and due primarily to the publicity accorded wilderness areas, or whether the increased use will remain a long-term byproduct of the popularity of wilderness. If designation of wilderness in Grand Canyon National Park results in greater use of the backcountry, more management effort will be required to maintain the same level of resource protection from visitor activities. Some remote or fragile areas, such as archeological sites, caves, and bighorn habitats, may have a carrying capacity of zero, or nearly zero. Increased use in such areas could result in permanent or long-term damage to fragile environmental resources. Such damage might be avoided, at least in the short run, by no action and retention of the existing primitive area status and management.

Any economic impacts associated with the wilderness proposal are likely to be negative but minor with respect to taking no action. Economic benefits due to increased use due to wilderness designation would probably be offset by losses due to increased restrictions on consumptive uses of natural resources. Most of these restrictions are not implicit in the wilderness proposal, but rather would result from public pressure against such consumptive resource use on lands designated as wilderness units. Such public pressure would be less if the no action alternative is taken.

It is, however, unlikely that failure to designate wilderness in the proposed areas will alter their existing use and management appreciably. Most of the units are rugged, inaccessible, and unsuitable for either substantial recreational or consumptive uses of resources. The energy expenditure needed to develop these areas for other than primitive types of recreation is so great as to be economically unfeasible.

B. LESS WILDERNESS DESIGNATION

It is self-evident that the number of possible boundary permutations within a park as large as Grand Canyon is practically limitless. The preliminary wilderness proposal recommended by the National Park Service is essentially a maximum wilderness proposal. All lands which qualify, or which can be made to qualify through management actions, have been recommended for wilderness status; lands which do not qualify have not been recommended. A "more wilderness" alternative would include lands where man's presence and his works preclude such designation.

The less-wilderness alternative consists of the maximum wilderness proposal less one or more of the following areas which contain elements which remove them from the more puristic core wilderness of the Inner Canyon. None of man's intrusions into these areas disqualify them from wilderness status and all of the intrusions can be controlled or eliminated through management action. These areas are located on the map on page VIII-4, and identically number keyed to the alternatives which follow.

The impacts of including these areas have been covered in the Impacts of the Proposed Action section of this statement. The impacts of excluding one or more of these areas from the wilderness proposal will parallel those of the No Action alternative for each area deleted. The quantitative impact of less wilderness is interrelated to the cumulative amount of land deleted from the proposal. The primary impacts of less wilderness would be to break the remaining wilderness status lands into lesser blocks lacking in contiguous integrity, and to allow for non-wilderness developments to penetrate deep into and between wilderness status lands.

Areas which could be deleted from the Wilderness Proposal to form alternative proposals are given below.

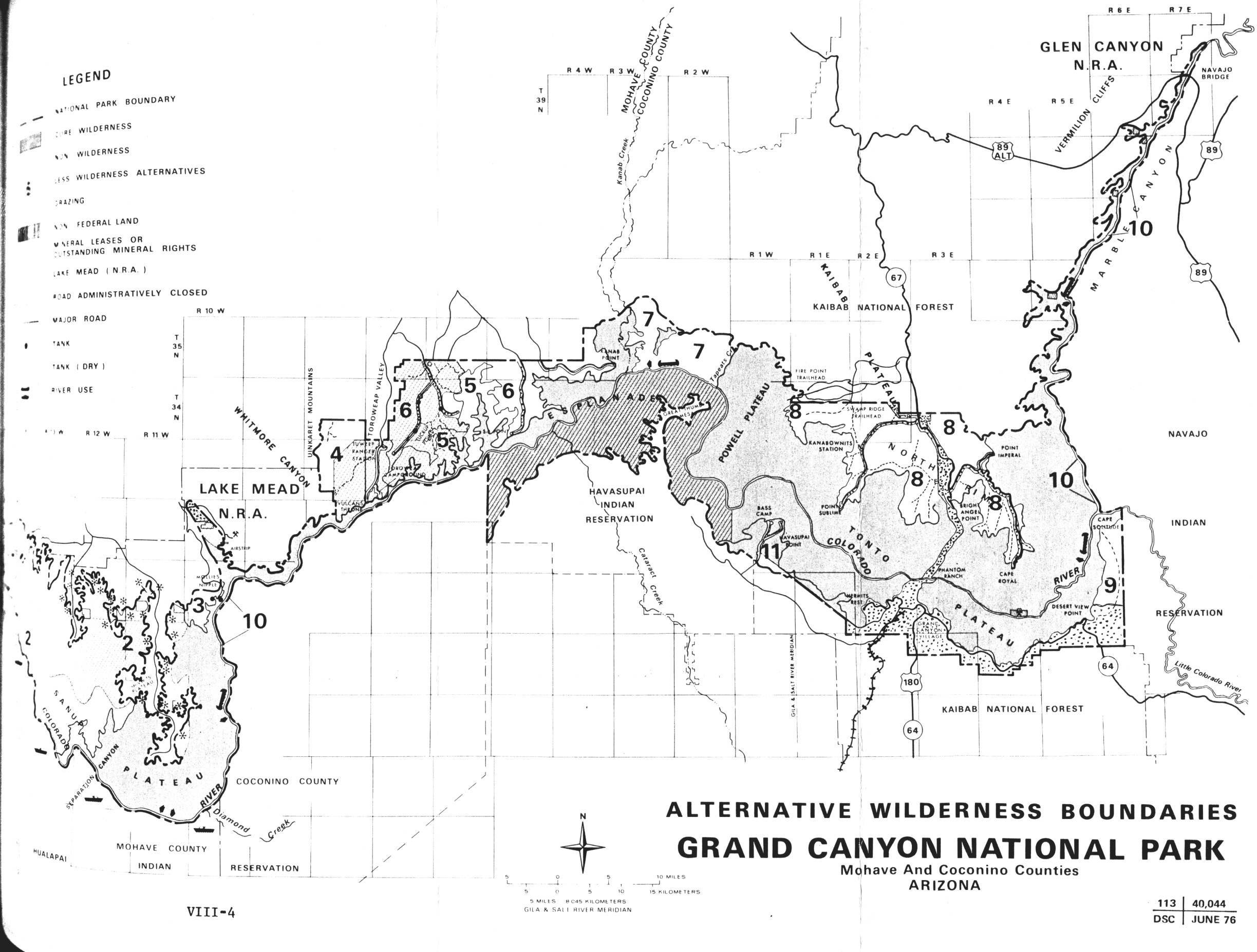
1. South Grand Wash Cliffs

This area contains two roads, water catchments for cattle, grazing, and is bounded to the south by private lands which have been subdivided for land development. Grazing will terminate by 1985 and the water catchments and roadways eliminated and restored to a near-natural state.

Deletion of this area would have the effect of eliminating all of the approximately 13,575 acres of land in Unit 1 from the Wilderness Proposal. The southern Grand Wash Cliffs at the mouth of Grand Canyon would not receive wilderness protection and would remain in natural area status. Pressure from land developments directly south of this unit could lead to extensive recreation developments and facilities in the southern Grand Wash Cliffs and along the south bank of the Colorado River. No salient of non-wilderness lands into the core wilderness of the canyon would be created if this area were deleted from the Wilderness Proposal.

2. Grazed Portions of the Sanup Plateau

This area contains primitive roadways, water catchments, grazing, two tramway towers, tramway cable, and steel ladders at Bat Cave. The primitive landing strip developed on Lake Mead silts at mile 265 on the Colorado River and is considered as part of the River Corridor. Again, the roadways and water catchments can be restored to a near-natural state through management action, and grazing in the area will terminate by 1985. The ladders, towers, and cable at Bat Cave can be dismantled and removed by boat or helicopter.



ALTERNATIVE WILDERNESS BOUNDARIES

GRAND CANYON NATIONAL PARK

Mohave And Coconino Counties
ARIZONA

113	40,044
DSC	JUNE 76

Deletion of this area would have the effect of eliminating approximately 72,397 acres of land from the wilderness proposal in Unit 2. The major portion of the Sanup Plateau would be removed from the proposal. This is one of the most primitive and unscarred areas within the park.

3. Mollies Nipple

This area contains two primitive roads, water catchments, and has grazing permits on it. Management actions can return this area to a more puristic wilderness by eliminating the roadways and water catchments and restoring the areas involved. Grazing permits expire within the next ten years.

Deletion of this area would have the effect of eliminating approximately 5,274 acres of land from the Wilderness Proposal in Unit 2. It would provide a salient of natural area lands into the wilderness of Unit 2, leaving only a narrow strip of wilderness on the west bank of the Colorado River. This would nearly sever the western one-third of the Grand Canyon wilderness from the eastern two-thirds.

4. Southern Uinkaret Mountains

This area also has primitive roadways and grazing permits on it. There have also been past alterations of the land in soil and water conservation manipulations. Management actions can restore this land to a near-natural state. When the current lifetime permits expire, grazing will terminate.

Deletion of this area would have the effect of eliminating approximately 24,115 acres of land from the Wilderness Proposal in Unit 2. No salient of non-wilderness lands would be created if this area were deleted from the proposed action. If not placed in wilderness status, the recreational developments in Toroweap Valley could eventually spread into this area under natural area designation.

5. Tuckup Canyon and Esplanade

This area contains livestock grazing and approximately two miles of primitive roadway. Grazing will cease with the expiration of a lifetime permit. Management actions can restore the roadways to a near-natural state.

Deletion of this area would have the effect of eliminating approximately 35,937 acres of land from the Wilderness Proposal in Unit 2. Deletion would leave this area as a non-wilderness island, sandwiched between the wilderness of the Kanab Plateau and that of the Inner Canyon of the Colorado River.

6. Kanab Plateau

Grazing occurs, but will cease with the expiration of a lifetime permit. Roads, tanks, and catchments utilized for grazing purposes can be returned to a near-natural state through management actions.

Deletion of this area would have the effect of eliminating approximately 64,276 acres of land from the Wilderness Proposal in Unit 2. If combined with the deletion of area 5 above, they would effectively separate the eastern and western wilderness areas of the park by approximately 20 miles.

7. Lower Kanab Canyon

This area has a grazing permit which will expire in May 1976. No roadways, water catchments, or other developments for grazing are within this area. Deletion of this area would have the effect of eliminating approximately 29,542 acres of land from the Wilderness Proposal in Unit 2. It would also provide a non-wilderness salient through the north side of the park to the Colorado River and separate core wilderness areas. It would also have the effect of allowing for the future development of a non-wilderness recreational-use area near the popular Tapeats Creek-Thunder River area.

8. Kaibab Plateau

This area contains numerous roads used for fire management and access into the backcountry of the North Rim. These roadways are no longer needed for fire management and are currently being closed by administrative action. The fire tower at Kanabowits Station is no longer used and is to be removed and the area surrounding it restored to a near-natural state. The area contains the majority of the heavily forested uplands within the Wilderness Proposal.

Deletion of this area would have the effect of eliminating approximately 87,575 acres of land from the Wilderness Proposal in Unit 2. The primary forest ecosystem of the Grand Canyon wilderness would not be given wilderness status. Fire management actions could be done with mechanized equipment and recreational facilities could be developed throughout the forested North Rim of Grand Canyon National Park. The winter use of snowmobiles could also be permitted throughout the area if it remains classified as a natural area.

9. Cape Solitude - Palisades of the Desert

This area contains a jeep trail to Cape Solitude and rim viewpoints of the Nankoweep area and the junction of the Colorado and Little Colorado

rivers. Management action can close this jeep trail and return it to a near-natural state. Similar views may be had from the Navajo Tribal Park which adjoins Grand Canyon National Park north of the river junction.

Deletion of this area from Unit 4 would have the effect of reducing the Wilderness Proposal by 12,339 acres. Deleting this area would not create a non-wilderness salient into other proposed wilderness areas.

10. River Corridor

Although it is the heart of the wilderness backcountry of Grand Canyon National Park, the 17,009-acre Colorado River Corridor is not recommended for wilderness status because motorized craft are presently permitted on the river. Motorized craft are not necessary for enjoyment and use of this area, but are a convenience which enable river trips to be made in less time and permit the use of larger boats, accommodating larger groups of people.

The alternative to the proposed potential wilderness designation for the river corridor is to leave it as a natural area under the assumption that motor use will be permitted to continue indefinitely. The effect of this would be to remove 17,009 acres of potential wilderness from the Wilderness Proposal and to maintain a natural area corridor throughout the length of the wilderness core of Grand Canyon. This would assure motor trip operators of continued revenues from trips which can move rapidly through the canyon and give opportunity to visitors desiring the shorter trip option. It would eliminate the uncertainty in equipment investment felt by operators who are willing at the present time to operate totally non-motorized trips in the canyon. It would also result in continuing the motor noise which many river runners find objectionable.

11. Bass Camp - Pasture Wash

This area consists of rimlands in Unit 5 of the Wilderness Proposal. It extends from near Hermits Rest to the Havasupai Traditional Use Lands to the west of Pasture Wash. It contains a boundary fence road along its southern edge and the only access roads to Pasture Wash; Bass Camp; Havasupai Point; and the trailheads to the Bass, Boucher, and Waldron trails. There are old stock fences, water catchments, corrals, animal exclosures, a number of "unofficial" road tracks, and an abandoned fire tower at Signal Hill. Three miles south of this area, a paved road has been proposed by the Havasupai Tribe to link proposed residential and farming areas on the reservation with Grand Canyon Village. Several small outbuildings, a residence, a corral, and a trick tank for water are at Pasture Wash Ranger Station, which is to be manned on a year-round basis in the near future. Deletion of this area will reduce the Wilderness Proposal by 18,739 acres and not produce an intrusive salient into other proposed wilderness areas of the park.

IX. CONSULTATION AND COORDINATION WITH OTHERS

A. CONSULTATION AND COORDINATION IN THE DEVELOPMENT OF THE PROPOSAL AND IN THE PREPARATION OF THE DRAFT ENVIRONMENTAL STATEMENT

Consultation and coordination on wilderness recommendations have been underway on the Lake Mead National Recreation Area since 1974, and on Grand Canyon National Park since 1971. This material is contained in Appendix H of this statement and the information gathered during this period has been incorporated in developing the current preliminary wilderness proposal for the park as enlarged by the Grand Canyon Enlargement Act of 1975.

1. Consultation with the Public

Recent consultation and coordination on the current wilderness proposal began with pre-planning public meetings in September and October 1975. Pre-planning public workshops were held in Phoenix, Arizona on September 2[illegible] 1975; Kingman, Arizona on September 23; Kanab, Utah on September 26; Flagstaff, Arizona on September 30; and Grand Canyon, Arizona on October 2[illegible] The approximate attendance at each location was: Phoenix - 49, Kingman - 3, Las Vegas - 8, St. George - 0, Kanab - 6, Flagstaff - 19, and Grand Canyon - 69.

The purpose of the meetings was to identify public concerns and desires for wilderness designations within the enlarged boundary of Grand Canyon National Park. The enclosed matrix gives some indication of the wilderness values of people attending the workshops. Also provided is a review of organizations and interest groups represented.

GRAND CANYON WILDERNESS WORKSHOPS
September/October 1975

VALUES FOR PARK MANAGEMENT

RESOURCES / USES	No Wilderness	Wilderness Controlled by Natural Accessibility	"Defacto" Wilderness	All Roadless Areas of 5,000 Acres	Total Wilderness
USES					
Amenities to meet all demands. No location or type restrictions.					
Amenities for all but limited to present sites.			1		
Hold all amenities at present level.		3	16	45	2
No private vehicles. Closed transportation or hike in. Very limited amenities.			8	75	14
All amenities outside the park. Single hike in concept.					8

NOTE: This data resulted from an exercise conducted verbally with workshop participants prior to breaking into discussion groups.

GRAND CANYON WILDERNESS WORKSHOPS
September/October 1975

ORGANIZATION MEMBERSHIP OR REPRESENTATION

A.D.P.A.
American Museum of Natural History
American River Touring Association
American Society of Mammalogists
American Whitewater Association
Appalachian Mountain Club
AWW Inc.
Arizona Academy of Sciences
Arizona Conservation Council
Arizona Council Humanities and Public Policy
Arizona Daily Sun
Arizona Historical Advisory Commission
Arizona Mountaineering Club (two participants)
Arizona Power Authority
Arizona Public Service Company
Arizona Public Service Hiking Club
Arizona River Runner
Arizona Sonora Desert Museum
Arizona State Land Department
Arizona State University Aquatic Research Team
Arizona Wildlife Federation
Bellco Road and Gun Club
Botanical Society of America
Bureau of Indian Affairs
Bureau of Reclamation
Canyoneers Incorporated (six participants)
Chaparral Environmental Club
C.M.T.A.F.
Coconino Citizens Association (three participants)
Colorado Mountain Club
Colorado Whitewater Association
Committee for Arizona Way
Defenders of Wildlife
Desert Protective Council (two participants)
D.P. and Wildlife Society
Ecological Society of America
Environmental Defense Fund
Faculty Women's Association
Federation of Wildlife
Friends of the Earth (seven participants)
Geology Department, University of Nevada, Las Vegas
Grand Canyon College
Grand Canyon Dories

Grand Canyon Natural History Association
Grand Canyon Historical Society
Grand Canyon Trail Guides
Guadalupe Mountains National Park (two participants)
Hatch River Expeditions
Havasupai Tribe Land Use Planning Committee
Havasupai Tribe (two participants)
Hualapai Grand Canyon Outfitter
Hualapai Tribal Council (two participants)
Lab of Paleoenvironmental Studies, University of Arizona
Lake Mead National Recreation Area (two participants)
Lake Mead Research Basic Inventory
Las Vegas Jeep Club
League of Women Voters
Means Wildlife Society
Museum of Northern Arizona (four participants)
National Audubon Society (eight participants)
National Campers and Hikers Association (three participants)
National Parks and Conservation Association (four participants)
National Recreation and Park Association
National Speleological Society (three participants)
National Trust for Scotland
Nature Conservancy
Navajo Tribe (four participants)
Navajo Tribal Museum
New Mexico Wilderness Study Committee
Nevada Open Spaces Council
Northern Aqua Aki Kayak Club
Northern Arizona University Geology Club
Northern Arizona University Hiking Club
Park Service Concessionaire
Phelps - Dodge Corporation
Parks Commission Navajo Nation
Plateau Sciences Society
Professional River Outfitters Association
Public River Outfitters
Red Rock Resources Citizens Committee
Rocky Mountain Expedition Inc. (two participants)
R and O River Guides
Saguaro High Ecology Club (seven participants)
Sanderson River Expeditions
Sierra Club (thirty-one participants)
Sigma Xi (two participants)
Society for American Archaeology
Society of Range Management
S.R.L.
Student Environmental Workshop (two participants)

Southern Arizona Hiking Club (three participants)
Southern Environmental Council
Southwest Regional Representative
Sundance River Expeditions Inc.
University of Arizona Herbarium
University of Nevada, Las Vegas
Western River Guides Association (four participants)
Wilderness Public Rights Fund
Wilderness World
Wilderness Society (thirteen participants)

NOTE: The meaning of some abbreviations for organizations is unknown but were listed above.

2. Coordination with Other Agencies

On November 13, 1975, a meeting was held with the Forest Supervisor, Kaibab National Forest, and his staff, Superintendent of Grand Canyon National Park, the Regional Director, Western Region, NPS, and Denver Service Center, NPS representatives concerning regional planning. The Forest Service is concerned about closing fire control roads and wilderness designation on the North Rim, since it would require constructing trailheads on National Forest land and perhaps require the Forest Service to consider wilderness on lands under its jurisdiction north of the park boundary.

The current proposal recommends trailheads on Park Service land, therefore alleviating the Forest Service from the responsibility of constructing trailheads. The Park Service has no control over public desires on uses for Forest Service land. However, to date there has been no interest expressed by the public for wilderness classification north of the park boundary. The Forest Service will be consulted and will be kept appraised of the Park Service proposal as it develops.

The Western Region Advisory Board has been kept informed of the status of the proposal.

Meetings with personnel of the Arizona Strip Office and the Kingman Area Office of the Bureau of Land Management were held in the summer and fall of 1975 to discuss the park suitability study, grazing, and the status of the wilderness study.

During the fall of 1975, park personnel met with the Havasupai Tribal chairman, members of the Havasupai Planning Committee and the Bureau of Indian Affairs Planning Group. A workshop was also conducted by the Havasupai Tribal Council to discuss preliminary planning proposals for the Havasupai Land Use Plan. Discussions pertaining to the wilderness proposal concerned backcountry use in the traditional use lands, trails crossing the reservation lands which may be needed by hikers to gain access to various portions of the national park, and a cooperative system for management of backcountry use in areas that border the Havasupai Reservation.

Meetings were held with the Cameron chapter of the Navajo Tribe to discuss boundary issues, trespass grazing, and wilderness designation.

B. COORDINATION IN THE REVIEW OF THE DRAFT ENVIRONMENTAL STATEMENT

Comments will be requested of the following:

Advisory Council on Historic Preservation
Department of Agriculture
  Forest Service
  Soil Conservation Service
Department of the Interior
  Bureau of Indian Affairs
  Bureau of Land Management
  Bureau of Mines
  Bureau of Outdoor Recreation
  Bureau of Reclamation
  Fish and Wildlife Service
  Geological Survey
Department of Transportation
  Coast Guard
  Federal Aviation Administration
Environmental Protection Agency
Federal Power Commission

Arizona State Clearinghouse
  Arizona State Historic Preservation Officer
  Northern Arizona Council of Governments
Nevada State Clearinghouse
Utah State Clearinghouse

Havasupai Tribal Council
Hopi Tribal Council
Hualapai Tribal Council
Navajo Tribal Council

Informational copies will be sent to the following:

Coconino County Board of Supervisors
Coconino County Planner and Director
Mohave County Planning and Zoning Commission

Cocopai Resource Conservation Development Project

City Manager, Kingman, Arizona
City Manager, Williams, Arizona
Mayor, Flagstaff, Arizona
Mayor, Kanab, Utah
Mayor, St. George, Utah

Arizona Academy of Science
Advisory Commission of Arizona Environment
Aircraft Owners and Pilots Association
Arizona Conservation Council
Arizona Desert Bighorn Sheep Society, Inc.

Arizona Friends of the Earth
Arizona Mountaineering Club
Arizona Parks and Recreation Association
Arizona Wildlife Federation
Arizona Wildlife Society
Arizona-New Mexico Wildlife Society
Arizonans for Quality Environment
Citizens for a Best Environment
Colorado Plateau Environmental Advisory Board
Colorado River Wildlife Council
Conservation Foundation
Desert Protection Council
DNA-People's Legal Services
Environmental Conscience Corporation
Federation of Western Outdoor Clubs
Lord's Earth Committee
Maricopa Audubon Society
Mearns Wildlife Society
Museum of Northern Arizona
National Audubon Society
National Parks and Conservation Association
National Wildlife Federation
Nature Conservancy
Navajo Tribal Museum
Nevada Open Spaces Council
Saguaro Conservation and Ecology Club
S.A.V.E.
Save the Grand Canyon Committee
School of American Research
Sierra Club, Southwest Office
Sierra Club, Palo Verde Chapter
Southern Arizona Hiking Club
Southern Nevada Resources Action Council
Tucson Audubon Society
Utah Environment Center
Wilderness Society

American River Touring Association
Arizona Cattle Growers Association
Arizona Daily Star
Arizona Daily Sun
Arizona Public Service Co.
Arizona River Runners, Inc.
Babbitt Brothers Trading Co.
Canyon Food Mart
Canyon Squire Motel
Canyoneers, Inc.
Colorado River and Trail Expeditions, Inc.

Cross Tours and Explorations, Inc.
Flagstaff Chamber of Commerce
Fort Lee Company
Four Corners Regional Commission
Fred Harvey Company
Georgie's Royal River Rats
Globe Ranch
Grand Canyon Airlines
Grand Canyon Airport
Grand Canyon Dories
Grand Canyon Expeditions
Grand Canyon Gas Company
Grand Canyon Scenic Rides
Grand Canyon Schools
Grand Canyon-Tusayan Chamber of Commerce
Grand Canyon Youth Expeditions, Inc.
Harris Boat Trips
Hatch River Expeditions
Hughes Air West
Kane County Record
Kolb Studio
Moki Mac River Expeditions
Moqui Lodge
Mountain States Telephone
O.A.R.S., Inc.
Outdoors Unlimited
Recreation Equipment, Inc.
Red Feather Lodge
ROMA
Salt River Project
Sanderson River Expeditions
Santa Fe Railway Co.
Scenic Airlines, Inc.
Skidmore, Owings and Merrill
Spencer, Lee, Stypula and Busse
Tour West, Inc.
Tri-State Flight Operations
Valley National Bank
Verkamp's
Western River Expeditions, Inc.
White Water River Expeditions
Wilderness World
Williams Chamber of Commerce
Williams News
Wonderland Expeditions

A P P E N D I C E S

APPENDIX A

WILDERNESS ACT

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SHORT TITLE

SECTION 1. This Act may be cited as the "Wilderness Act."

WILDERNESS SYSTEM ESTABLISHED—STATEMENT OF POLICY

SECTION 2. (a) In order to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition, it is hereby declared to be the policy of the Congress to secure for the American people of present and future generations the benefits of an enduring resource of wilderness. For this purpose there is hereby established a National Wilderness Preservation System to be composed of federally owned areas designated by Congress as "wilderness areas", and these shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness; and no Federal lands shall be designated as "wilderness areas" except as provided for in this Act or by a subsequent Act.

(b) The inclusion of an area in the National Wilderness Preservation System notwithstanding, the area shall continue to be managed by the Department and agency having jurisdiction thereover immediately before its inclusion in the National Wilderness Preservation System unless otherwise provided by Act of Congress. No appropriation shall be available for the payment of expenses or salaries for the administration of the National Wilderness Preservation System as a separate unit nor shall any appropriations be available for additional personnel stated as being required solely for the purpose of managing or administering areas solely because they are included within the National Wilderness Preservation System.

DEFINITION OF WILDERNESS

(c) A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

NATIONAL WILDERNESS PRESERVATION SYSTEM — EXTENT OF SYSTEM

SECTION 3. (a) All areas within the national forests classified at least 30 days before the effective date of this Act by the Secretary of Agriculture or the Chief of the Forest Service as "wilderness," "wild," or "canoe" are hereby designated as wilderness areas. The Secretary of Agriculture shall—

(1) Within one year after the effective date of this Act, file a map and legal description of each wilderness area with the Interior and Insular Affairs Committees of the United States Senate and the House of Representatives, and such descriptions shall have the same force and effect as if included in this Act: *Provided, however,* That correction of clerical and typographical errors in such legal descriptions and maps may be made.

(2) Maintain, available to the public, records pertaining to said wilderness areas, including maps and legal descriptions, copies of regulations governing them, copies of public notices of, and reports submitted to Congress regarding pending additions, eliminations, or modifications. Maps, legal descriptions, and regulations pertaining to wilderness areas within their respective jurisdictions also shall be available to the public in the offices of regional foresters, national forest supervisors, and forest rangers.

Classification. (b) The Secretary of Agriculture shall, within ten years after the enactment of this Act, review, as to its suitability or nonsuitability for preservation as wilderness, each area in the national forests classified on the effective date of this Act by the Secretary of Agriculture or the Chief of the Forest Service as "primitive" and report his findings to the President.

Presidential recommendation to Congress. The President shall advise the United States Senate and House of Representatives of his recommendations with respect to the designation as "wilderness" or other

reclassification of each area on which review has been completed, together with maps and a definition of boundaries. Such advice shall be given with respect to not less than one-third of all the areas now classified as "primitive" within three years after the enactment of this Act, not less than two-thirds within seven years after the enactment of this Act, and the remaining areas within ten years after the enactment of this Act.

Congressional approval. Each recommendation of the President for designation as "wilderness" shall become effective only if so provided by an Act of Congress. Areas classified as "primitive" on the effective date of this Act shall continue to be administered under the rules and regulations affecting such areas on the effective date of this Act until Congress has determined otherwise. Any such area may be increased in size by the President at the time he submits his recommendations to the Congress by not more than five thousand acres with no more than one thousand two hundred and eighty acres of such increase in any one compact unit; if it is proposed to increase the size of any such area by more than five thousand acres or by more than one thousand two hundred and eighty acres in any one compact unit the increase in size shall not become effective until acted upon by Congress. Nothing herein contained shall limit the President in proposing, as part of his recommendations to Congress, the alteration of existing boundaries of primitive areas or recommending the addition of any contiguous area of national forest lands predominantly of wilderness value. Notwithstanding any other provisions of this Act, the Secretary of Agriculture may complete his review and delete such area as may be necessary, but not to exceed seven thousand acres, from the southern tip of the Gore Range-Eagles Nest Primitive Area, Colorado, if the Secretary determines that such action is in the public interest.

Report to President. (c) Within ten years after the effective date of this Act the Secretary of the Interior shall review every roadless area of five thousand contiguous acres or more in the national parks, monuments and other units of the national park system and every such area of, and every roadless island within, the national wildlife refuges and game ranges, under his jurisdiction on the effective date of this Act and shall report to the President his recommendation as to the suitability or nonsuitability of each such area or island for preservation as wilderness.

Presidential recommendation to Congress. The President shall advise the President of the Senate and the Speaker of the House of Representatives of his recommendation with respect to the designation as wilderness of each such area or island on which review has been completed, together with a map thereof and a definition of its boundaries. Such advice shall be given with respect to not less than one-third of the areas and islands to be reviewed under this subsection within three years after enactment of this Act, not less than two-thirds within seven years of enactment of this Act, and the remainder within ten years of enactment of this Act.

Congressional approval. A recommendation of the President for designation as wilderness shall become effective only if so provided by an Act of Congress. Nothing contained herein shall, by implication or other-

wise, be construed to lessen the present statutory authority of the Secretary of the Interior with respect to the maintenance of roadless areas within units of the national park system.

Suitability. (d) (1) The Secretary of Agriculture and the Secretary of the Interior shall, prior to submitting any recommendations to the President with respect to the suitability of any area for preservation as wilderness—

Publication in Federal Register. (A) give such public notice of the proposed action as they deem appropriate, including publication in the Federal Register and in a newspaper having general circulation in the area or areas in the vicinity of the affected land;

Hearings. (B) hold a public hearing or hearings at a location or locations convenient to the area affected. The hearings shall be announced through such means as the respective Secretaries involved deem appropriate, including notices in the Federal Register and in newspapers of general circulation in the area: *Provided.* That if the lands involved are located in more than one State, at least one hearing shall be held in each State in which a portion of the land lies;

(C) at least thirty days before the date of a hearing advise the Governor of each State and the governing board of each county, or in Alaska the borough, in which the lands are located, and Federal departments and agencies concerned, and invite such officials and Federal agencies to submit their views on the proposed action at the hearing or by no later than thirty days following the date of the hearing.

(2) Any views submitted to the appropriate Secretary under the provisions of (1) of this subsection with respect to any area shall be included with any recommendations to the President and to Congress with respect to such area.

Proposed modification. (e) Any modification or adjustment of boundaries of any wilderness area shall be recommended by the appropriate Secretary after public notice of such proposal and public hearing or hearings as provided in subsection (d) of this section. The proposed modification or adjustment shall then be recommended with map and description thereof to the President. The President shall advise the United States Senate and the House of Representatives of his recommendations with respect to such modification or adjustment and such recommendations shall become effective only in the same manner as provided for in subsections (b) and (c) of this section.

USE OF WILDERNESS AREAS

SECTION 4. (a) The purposes of this Act are hereby declared to be within and supplemental to the purposes for which national forests and units of the national park and wildlife refuge systems are established and administered and—

(1) Nothing in this Act shall be deemed to be in interference with the purpose for which national forests are established as set forth in the Act of June 4, 1897 (30 Stat. 11), and the Multiple-Use Sustained-Yield Act of June 12, 1960 (74 Stat. 215).

(2) Nothing in this Act shall modify the restrictions and provisions of the Shipstead-Nolan Act (Public Law 539, Seventy-first Congress, July 10, 1930; 46 Stat. 1020), the Thye-Blatnik Act (Public Law 733, Eightieth Congress, June 22, 1948; 62 Stat. 568), and the Humphrey-Thye-Blatnik-Andresen Act (Public Law 607, Eighty-fourth Congress, June 22, 1956; 70 Stat. 326), as applying to the Superior National Forest or the regulations of the Secretary of Agriculture.

(3) Nothing in this Act shall modify the statutory authority under which units of the national park system are created. Further, the designation of any area of any park, monument, or other unit of the national park system as a wilderness area pursuant to this Act shall in no manner lower the standards evolved for the use and preservation of such park, monument, or other unit of the national park system in accordance with the Act of August 25, 1916, the statutory authority under which the area was created, or any other Act of Congress which might pertain to or affect such area, including, but not limited to, the Act of June 8, 1906 (34 Stat. 225; 16 U.S.C. 432 et seq.); section 3(2) of the Federal Power Act (16 U.S.C. 796 (2)); and the Act of August 21, 1935 (49 Stat. 666; 16 U.S.C. 461 et seq.).

(b) Except as otherwise provided in this Act, each agency administering any area designated as wilderness shall be responsible for preserving the wilderness character of the area and shall so administer such area for such other purposes for which it may have been established as also to preserve its wilderness character. Except as otherwise provided in this Act, wilderness areas shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use.

PROHIBITION OF CERTAIN USES

(c) Except as specifically provided for in this Act, and subject to existing private rights, there shall be no commercial enterprise and no permanent road within any wilderness area designated by this Act and, except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act (including measures required in emergencies involving the health and safety of persons within the area), there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area.

SPECIAL PROVISIONS

(d) The following special provisions are hereby made:

(1) Within wilderness areas designated by this Act the use of aircraft or motorboats, where these uses have already become established, may be permitted to continue subject to such restrictions as the Secretary of Agriculture deems desirable. In addition, such measures may be taken as

such rights as may be necessary to assure adequate access to such State-owned or privately owned land by such State or private owner and their successors in interest, or the State-owned land or privately owned land shall be exchanged for federally owned land in the same State of approximately equal value under authorities available to the Secretary of Agriculture:

Transfers, restriction. Provided, however, That the United States shall not transfer to a State or private owner any mineral interests unless the State or private owner relinquishes or causes to be relinquished to the United States the mineral interest in the surrounded land.

(b) In any case where valid mining claims or other valid occupancies are wholly within a designated national forest wilderness area, the Secretary of Agriculture shall, by reasonable regulations consistent with the preservation of the area as wilderness, permit ingress and egress to such surrounded areas by means which have been or are being customarily enjoyed with respect to other such areas similarly situated.

Acquisition. (c) Subject to the appropriation of funds by Congress, the Secretary of Agriculture is authorized to acquire privately owned land within the perimeter of any area designated by this Act as wilderness if (1) the owner concurs in such acquisition or (2) the acquisition is specifically authorized by Congress.

GIFTS, BEQUESTS, AND CONTRIBUTIONS

SECTION. 6. (a) The Secretary of Agriculture may accept gifts or bequests of land within wilderness areas designated by this Act for preservation as wilderness. The Secretary of Agriculture may also accept gifts or bequests of land adjacent to wilderness areas designated by this Act for preservation as wilderness if he has given sixty days advance notice thereof to the President of the Senate and the Speaker of the House of Representatives. Land accepted by the Secretary of Agriculture under this section shall become part of the wilderness area involved. Regulations with regard to any such land may be in accordance with such agreements, consistent with the policy of this Act, as are made at the time of such gift, or such conditions, consistent with such policy, as may be included in, and accepted with, such bequest.

(b) The Secretary of Agriculture or the Secretary of the Interior is authorized to accept private contributions and gifts to be used to further the purposes of this Act.

ANNUAL REPORTS

SECTION 7. At the opening of each session of Congress, the Secretaries of Agriculture and Interior shall jointly report to the President for transmission to Congress on the status of the wilderness system, including a list and descriptions of the areas in the system, regulations in effect, and other pertinent information, together with any recommendations they may care to make.

Mineral leases, permits, and licenses covering lands within national forest wilderness areas designated by this Act shall contain such reasonable stipulations as may be prescribed by the Secretary of Agriculture for the protection of the wilderness character of the land consistent with the use of the land for the purposes for which they are leased, permitted, or licensed. Subject to valid rights then existing, effective January 1, 1984, the minerals in lands designated by this Act as wilderness areas are withdrawn from all forms of appropriation under the mining laws and from disposition under all laws pertaining to mineral leasing and all amendments thereto.

Water resources. (4) Within wilderness areas in the national forests designated by this Act, (1) the President may, within a specific area and in accordance with such regulations as he may deem desirable, authorize prospecting for water resources, the establishment and maintenance of reservoirs, water-conservation works, power projects, transmission lines, and other facilities needed in the public interest, including the road construction and maintenance essential to development and use thereof, upon his determination that such use or uses in the specific area will better serve the interests of the United States and the people thereof than will its denial; and (2) the grazing of livestock, where established prior to the effective date of this Act, shall be permitted to continue subject to such reasonable regulations as are deemed necessary by the Secretary of Agriculture.

(5) Other provisions of this Act to the contrary notwithstanding, the management of the Boundary Waters Canoe Area, formerly designated as the Superior, Little Indian Sioux, and Caribou Roadless Areas, in the Superior National Forest, Minnesota, shall be in accordance with regulations established by the Secretary of Agriculture in accordance with the general purpose of maintaining, without unnecessary restrictions on other uses, including that of timber, the primitive character of the area, particularly in the vicinity of lakes, streams, and portages: *Provided*, That nothing in this Act shall preclude the continuance within the area of any already established use of motorboats.

(6) Commercial services may be performed within the wilderness areas designated by this Act to the extent necessary for activities which are proper for realizing the recreational or other wilderness purposes of the areas.

(7) Nothing in this Act shall constitute an express or implied claim or denial on the part of the Federal Government as to exemption from State water laws.

(8) Nothing in this Act shall be construed as affecting the jurisdiction or responsibilities of the several States with respect to wildlife and fish in the national forests.

STATE AND PRIVATE LANDS WITHIN WILDERNESS AREAS

SECTION 5. (a) In any case where State-owned or privately owned land is completely surrounded by national forest lands within areas designated by this Act as wilderness, such State or private owner shall be given

may be necessary in the control of fire, insects, and diseases, subject to such conditions as the Secretary deems desirable.

(2) Nothing in this Act shall prevent within national forest wilderness areas any activity, including prospecting, for the purpose of gathering information about mineral or other resources, if such activity is carried on in a manner compatible with the preservation of the wilderness environment. Furthermore, in accordance with such program as the Secretary of the Interior shall develop and conduct in consultation with the Secretary of Agriculture, such areas shall be surveyed on a planned, recurring basis consistent with the concept of wilderness preservation by the Geological Survey and the Bureau of Mines to determine the mineral values, if any, that may be present; and the results of such surveys shall be made available to the public and submitted to the President and Congress.

Mineral leases, claims, etc. (3) Notwithstanding any other provisions of this Act, until midnight December 31, 1983, the United States mining laws and all laws pertaining to mineral leasing shall, to the same extent as applicable prior to the effective date of this Act, extend to those national forest lands designated by this Act as "wilderness areas"; subject, however, to such reasonable regulations governing ingress and egress as may be prescribed by the Secretary of Agriculture consistent with the use of the land for mineral location and development and exploration, drilling, and production, and use of land for transmission lines, waterlines, telephone lines, or facilities necessary in exploring, drilling, producing, mining, and processing operations, including where essential the use of mechanized ground or air equipment and restoration as near as practicable of the surface of the land disturbed in performing prospecting, location, and, in oil and gas leasing, discovery work, exploration, drilling, and production, as soon as they have served their purpose. Mining locations lying within the boundaries of said wilderness areas shall be held and used solely for mining or processing operations and uses reasonably incident thereto; and hereafter, subject to valid existing rights, all patents issued under the mining laws of the United States affecting national forest lands designated by this Act as wilderness areas shall convey title to the mineral deposits within the claim, together with the right to cut and use so much of the mature timber therefrom as may be needed in the extraction, removal, and beneficiation of the mineral deposits, if the timber is not otherwise reasonably available, and if the timber is cut under sound principles of forest management as defined by the national forest rules and regulations, but each such patent shall reserve to the United States all title in or to the surface of the lands and products thereof, and no use of the surface of the claim or the resources therefrom not reasonably required for carrying on mining or prospecting shall be allowed except as otherwise expressly provided in this Act: *Provided*, That, unless hereafter specifically authorized, no patent within wilderness areas designated by this Act shall issue after December 31, 1983, except for the valid claims existing on or before December 31, 1983. Mining claims located after the effective date of this Act within the boundaries of wilderness areas designated by this Act shall create no rights in excess of those rights which may be patented under the provisions of this subsection.

Approved September 3, 1964.

LEGISLATIVE HISTORY:

HOUSE REPORTS:
No. 1538 accompanying H. R. 9070 (Committee on Interior & Insular Affairs) and No. 1829 (Committee of Conference).

SENATE REPORT:
No. 109 (Committee on Interior & Insular Affairs).

CONGRESSIONAL RECORD:

Vol. 109 (1963): April 4, 8, considered in Senate.
April 9, considered and passed Senate.
Vol. 110 (1964): July 28, considered in House.
July 30, considered and passed House, amended, in lieu of H. R. 9070.
August 20, House and Senate agreed to conference report.

APPENDIX B

DEPARTMENTAL GUIDELINES FOR WILDERNESS PROPOSALS

United States Department of the Interior

Office of the Secretary
Washington, D.C. 20240

June 24, 1972

Memorandum

To: Director, Bureau of Sport Fisheries and Wildlife

Director, National Park Service

From: Assistant Secretary for Fish and Wildlife and Parks

Subject: Guidelines for Wilderness Proposals – Reference Secretarial Order No. 2920

In the course of developing wilderness proposals we should strive to give the areas under study wilderness designation but not at the expense of losing the essential management prerogatives that are necessary to fulfill the purposes for which the areas were originally intended. Although each area under study must be considered separately, with special attention given to its unique characters, the following criteria should be adhered to when determining the suitability of an area for wilderness designation.

Management

An area should not be excluded from wilderness designation solely because established or proposed management practices require the use of tools, equipment or structures, if these practices are necessary for the health and safety of wilderness travelers, or the protection of the wilderness area. The manager should use the *minimum* tool, equipment or structure necessary to successfully, safely and economically accomplish the objective. When establishing the minimum tool

and equipment necessary for a management need within wilderness areas economic factors should be considered the least important of the three criteria. The chosen tool or equipment should be the one that least degrades wilderness values temporarily or permanently.

For the purpose of this paragraph, accepted tools, equipment, structures and practices may include but are not limited to: fire towers, patrol cabins, pit toilets, temporary roads, spraying equipment, hand tools, fire-fighting equipment caches, fencing and controlled burning. In special or emergency cases involving the health and safety of wilderness users or the protection of wilderness values aircraft, motorboats and motorized vehicles may be used. Enclaves, buffer zones, etc., should not be established if the desired management practices are permitted under these guidelines.

Visitor Use Structures and Facilities

An area that contains man-made facilities for visitor use can be designated as wilderness if these facilities are the minimum necessary for the health and safety of the wilderness traveler or the protection of wilderness resources. An example of a wilderness campsite that could be included is one having a pit toilet and fire rings made of natural materials and tent sites. A hand-operated water pump may be allowed. This kind of campsite would not be considered a permanent installation and could be removed or relocated as management needs dictate. Facilities that exceed the "minimum necessary" criteria will be removed and the area restored to its natural state. (See section on Exceptions.)

Areas containing campsites that require, for the protection of the adjacent wilderness values, facilities more elaborate than those allowed in a wilderness campsite should be excluded from wilderness designation.

Prior Rights and Privileges and Limited Commercial Services

Lands need not be excluded from wilderness designation solely because of prior rights or privileges such as grazing and stock driveways or certain limited commercial services that are proper for realizing the recreational or other wilderness purposes of the areas.

Road and Utilities – Structures and Installations

Areas that otherwise qualify for wilderness will not be excluded because they contain unimproved roads, created by vehicles repeatedly

traveling over the same course, structures, installations or utility lines, which can and would be removed upon designation as wilderness.

Research

Areas that otherwise qualify need not be excluded from wilderness designation because the area is being used as a site for research unless that use necessitates permanent structures or facilities in addition to those needed for management purposes.

Future Development

Those areas which presently qualify for wilderness designation but will be needed at some future date for specific purposes consistent with the purpose for which the National Park or National Wildlife Refuge was originally created, and fully described in an approved conceptual plan, should not be proposed for wilderness designation if they are not consistent with the above guidelines.

Exceptions

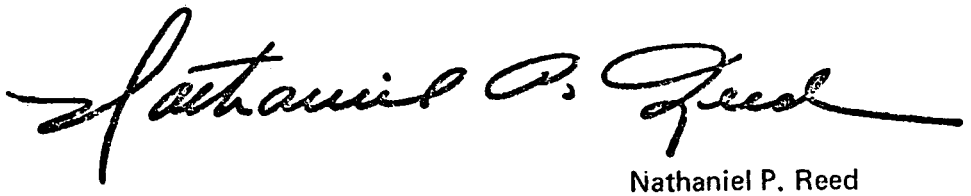
Certain areas being studied may contain structures such as small boat docks, water guzzlers and primitive shelters that ought to be retained but may not qualify as minimum structures necessary for the health and safety of wilderness users or the protection of the wilderness values of the area. When an area under study for wilderness designation would otherwise qualify as wilderness a specific provision may be included in the proposed legislation for this area, giving the wilderness manager the option of retaining and maintaining these structures. Necessary management practices such as controlled burning shall also be mentioned specifically in the proposed legislation.

Areas being considered for wilderness designation will not be excluded solely because they contain hydrologic devices that are necessary for the monitoring of water resources outside of the wilderness area. When these devices, either mechanical or electronic, are found to be necessary, a specific provision allowing their use will be included in the legislation proposing the wilderness area being considered. For the installation, servicing and monitoring of these devices the minimum tools and equipment necessary to safely and successfully accomplish the job will be used.

Areas being studied for wilderness designation will not be excluded solely because they contain lakes created by water development projects if these lakes are maintained at a relatively stable level and the shoreline has a natural appearance. Where this occurs and there is no other reason for excluding the area, a specific provision describing the water development project and its operation will be included in the proposed legislation along with the recommendation for including it in the wilderness area. Other minimal development of water resources may be suggested for inclusion in wilderness if specific reference is made to them in the proposed legislation. These provisions will allow present maintenance practices to continue.

Areas that contain underground utilities such as gas pipelines and transmission lines will not be excluded from wilderness designation solely for this reason. Where this occurs the areas may be included by making specific mention of them in the proposed legislation indicating that this use would continue and previously established maintenance practices would be allowed to continue.

When non-qualifying lands are surrounded by or adjacent to an area proposed for wilderness designation and such lands will within a determinable time qualify and be available Federal land, a special provision should be included in the legislative proposal giving the Secretary of the Interior the authority to designate such lands as wilderness at such time he determines it qualifies.



Nathaniel P. Reed

WILDERNESS PRESERVATION AND MANAGEMENT

THE NATIONAL PARK SERVICE WILL PRESERVE AN ENDURING RESOURCE OF WILDERNESS IN THE NATIONAL PARK SYSTEM AS PART OF THE NATIONAL WILDERNESS PRESERVATION SYSTEM, TO BE MANAGED FOR THE USE AND ENJOYMENT OF WILDERNESS VALUES WITHOUT IMPAIRMENT OF THE WILDERNESS RESOURCE.

From the earliest beginnings of the National Park System, the concept of wilderness preservation has been an integral part of park management philosophy. In the ensuing century, the national park movement has been a focal point for an evolving wilderness philosophy within our country.

In 1964 the efforts of the wilderness movement were capped by passage of the Wilderness Act (P.L. 88-577, 78 Stat. 890). The main thrust of the act was to establish a National Wilderness Preservation System and provide for the study of federal lands in the national forests, wildlife refuges, and the National Park System for inclusion in the system. Consistent with the Wilderness Act, no park area may be designated as wilderness except by an act of Congress.

The Wilderness Act specifies that designation of a park area as wilderness shall in no manner lower the standards evolved for the use and preservation of such park in accordance with the Act to Establish a National Park Service, August 25, 1916 (39 Stat. 535), and other applicable legislation.

Wilderness areas shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness. Thus, the preservation of wilderness character is the prime administrative responsibility of the Park Service, and other legal purposes of areas designated as wilderness must be administered so as to preserve the wilderness character. The public purposes for which park wilderness shall be managed relate to recreational, scenic, scientific, educational, conservation, and historical uses.

The National Park Service has conducted wilderness studies in conformity with the Wilderness Act, and the Secretary of the Interior has submitted legislative recommendations to the President and the Congress for designation of park areas as wilderness. The Park Service will continue wilderness studies on parks authorized since the passage of the Wilderness Act wherever required or desirable.

The policies contained in this chapter relate specifically to park wilderness or to park areas that have been studied and recommended for wilderness designation. Policies of general application to parks are contained in other chapters and are not repeated here. The Park Service's wilderness policies may vary from those of the Forest Service and the Fish and Wildlife Service, based on the differing missions of the three agencies. All, however, have as their goal the preservation of wilderness character.

The Park Service has traditionally used the term "backcountry" to refer to primitive, undeveloped portions of parks. This, however, is not a specific land classification as is wilderness, but refers to a general condition of land that may span several of the Park Service's land classifications that are essentially undeveloped and natural in character. Where the term wilderness is used, it will apply only to congressionally designated wilderness or to areas being studied or proposed for wilderness designation. The park "backcountry" would include the designated or proposed wilderness, but could also include other roadless lands which contain minor developments not appropriate in wilderness and provide for a number of different park purposes and activities.

WILDERNESS REVIEWS

The Park Service will continue to review areas that qualify for wilderness study, consistent with provisions of the Wilderness Act and subsequent legislation directing that wilderness studies be made. Wilderness studies shall be subject to compliance with the Procedures for the Protection of Historic and Cultural Properties promulgated by the Advisory Council on Historic Preservation.

Nature of Wilderness Land

The act defines wilderness, in part, as undeveloped federal land retaining its primeval character and influence which "generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable."

In interpreting this section, the Park Service considers lands that have been logged, farmed, grazed, or otherwise utilized in ways not involving extensive development or alteration of the landscape as qualifying for consideration of inclusion in wilderness proposals. Where such uses have impaired wilderness qualities, management will be directed toward restoration of wilderness character.

Management Considerations

An area will not be excluded from a wilderness recommendation solely because established or proposed management practices require the use of tools, equipment, or structures if those practices are necessary for the health and safety of wilderness travelers or protection of the wilderness area.

Grazing and Stock Driveways

Lands will not be excluded from a wilderness recommendation solely because of prior rights or privileges, such as grazing and stock driveways, provided these operations do not involve the routine use of motorized or mechanical equipment and do not involve development and structures to such an extent that the human imprint is substantially noticeable.

Historic Features

Historic features are not ordinarily included in wilderness. However, archaeological ruins and miscellaneous structures of historic significance occur in undeveloped portions of a number of parks. Such features may be included in a recommended wilderness when their use and the

requirements for maintenance and rehabilitation can be performed in accordance with wilderness management policies. Maintenance of the landscape so as to retain identity of historic travel routes, fields, etc., may not be undertaken.

Potential Wilderness Additions
When non-qualifying lands are surrounded by or adjacent to an area proposed for wilderness designation and such lands will within a determinable time qualify and be available federal land, a special provision should be included in the legislative proposal giving the Secretary of the Interior the authority to designate such lands as wilderness at such time he determines it qualifies.

Mining or Prospecting
Any recommendation that lands presently subject to mineral entry be designated wilderness will only be made subject to revocation of the mineral entry provision.

Utility Lines
Lands containing aboveground utility lines are not included in recommended wilderness. Areas containing underground utility lines may be included if the area otherwise qualifies as wilderness and the maintenance of the utility line does not require mechanized and motorized equipment.

WILDERNESS USE

Wilderness is recognized in the Wilderness Act as an area "where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain."

The visitor must accept wilderness largely on its own terms. Modern conveniences are not provided for the comfort of the visitor; and the risks of wilderness travel, of possible dangers from accidents, wildlife, and natural phenomena must be accepted as part of the wilderness experience.

For a majority of park visitors, park wilderness will be appreciated primarily from outside wilderness boundaries as part of the park scene, viewed from park roads and developments. To them, as well as to the visitor who hikes into the wilderness, protection of the wilderness character is essential to the quality of the park experience.

Information on Wilderness Use
Information on wilderness and backcountry use will be available in each park having such resources, specifying

- the kinds of clothing and equipment necessary for such use
- special dangers of wilderness use and precautions to be observed by the user
- regulations regarding wilderness and backcountry use

Limitation of Wilderness Use
If necessary to preserve the wilderness character, the Park Service will limit or disperse use through a variety of means best suited to the particular wilderness concerned.

Overnight Use
The Park Service may designate campsites where the level of overnight use indicates the need. Campsite facilities are to be the minimum necessary for the health and safety of the wilderness traveler and for the protection of the resources. Facilities may include an identifying site marker, pit toilet, tent sites, unobtrusive fire rings, and, if necessary, a hand-operated water pump.

Day Use
In smaller wilderness areas where the use pattern is essentially day use, provision of campsites may not be necessary, or they may be provided outside of wilderness boundaries.

Commercial Services
Provision of commercial services for guided riding, hiking, mountain climbing, and boat travel, and other similar services designed to aid wilderness enjoyment are permissible under careful control by each park as to their nature, number, and extent. Structures or facilities in support of such commercial services are not permitted within wilderness.

Caches
The storage of boats or other equipment by the public is not permitted. All equipment brought in must be taken out at the end of each wilderness trip.

Research

The Park Service, recognizing the scientific value of wilderness areas as natural outdoor laboratories, encourages those kinds of research and data gathering which require such areas for their accomplishment, and which will not adversely modify either the physical or biological resources and processes of the ecosystems, nor intrude upon or otherwise degrade the aesthetic values and recreational enjoyment of wilderness environments. All activities must be in accord with wilderness management policies.

Refuse Disposal

Refuse may not be disposed of within wilderness, except for the burning of combustible materials. The "carry out" concept will be implemented by each park containing wilderness.

Hydrometeorologic Devices

Hydrologic or hydrometeorologic devices are usually permanent or semi-permanent installations used to gather water and climatic data related to the management of resources outside of the wilderness. Such existing devices may be retained in wilderness. New or additional devices should not be placed in wilderness, except upon a finding by the Secretary of the Interior that essential information cannot be obtained from locations outside of wilderness and that the proposed device is the minimum tool to successfully and safely accomplish the objective. The installation, servicing, and monitoring of these devices shall be accomplished by such means as will assure human safety and will result in the minimum permanent and temporary adverse impact upon the wilderness environment.

WILDERNESS MANAGEMENT

In the management of wilderness resources and of wilderness use, the Park Service will use the minimum tool necessary to successfully, safely, and economically accomplish its management objectives. When establishing the minimum tool, economic factors should be considered the least important of the three criteria. The chosen tool or equipment should be the one that least degrades wilderness values temporarily or permanently. Accepted tools, equipment, structures, and practices may include but are not limited to: fire towers, patrol cabins, pit toilets, temporary roads, spraying equipment, hand tools, fire-fighting equipment, caches, fencing, and controlled burning. The specifics of wilderness management for a given park will be included in the park's resources management plan.

Motorized or Mechanical Equipment

As a general rule, use of motorized equipment or mechanical transport by the public is not allowed. Boating with hand propelled craft is an acceptable use of wilderness. Language customarily used in the National Park Service's recommended wilderness legislation would make applicable to the National Park Service a special provision of the Wilderness Act pertaining to the use of aircraft and motorboats. Under this provision, where the use of aircraft and motorboats has already become established, the use may be permitted to continue subject to such restrictions as the Secretary of the Interior deems desirable. This does not mean that previously established motorboat and aircraft uses of an area must be allowed to continue upon the designation of that area as wilderness or that water areas must be excluded from wilderness recommendation where motorboats are involved. Any recommendation to allow established aircraft or motorboat use to continue in wilderness would be based upon a finding that the purpose, character, and manner of such use is suitable to the specific wilderness under consideration.

Administrative use of motorized equipment or mechanical transport, including motorboats and aircraft, is permitted only as follows:

- in emergency cases involving the health and safety of wilderness users or the protection of wilderness values

- as necessary to meet the minimum needs of management to achieve the purpose of the area

MANAGEMENT FACILITIES

Wilderness is defined, in part, as undeveloped federal land retaining its primeval character and influence, without permanent improvements. Facilities are permitted only as necessary to meet the minimum requirements for the administration of the wilderness area.

Roads

Permanent roads are not permitted in wilderness. Where wilderness includes abandoned roads, their use by vehicles is not permitted and the road should be restored to a natural condition. Temporary vehicular access is permitted only to meet the minimum requirements of emergency situations.

Trails

Narrow, unpaved foot and horse trails are permissible.

Heliports, Helipads, Helispots, and Airstrips
Heliports, helipads, and airstrips are not permissible. Natural openings may be utilized as helispots. No site marking or improvements of any type will be permitted, except in conjunction with specific emergencies, after which the area will be restored.

Communications Facilities
Radio facilities are permitted where necessary for management of the wilderness area.

Fire Lookouts
Fire lookouts for wilderness protection are permitted where there is no adequate alternative method of fire detection.

Ranger Stations, Patrol Cabins, and Storage Structures
These structures are permitted only to the minimum extent necessary for wilderness management.

Fences and Hitching Racks
Fences and hitching racks are permitted only where essential for protection of the resource.

Chalets and Concessioner Camps
These facilities are not permissible.

Signs and Markers
Signs and markers may be provided only where they are necessary for visitor safety, management, or resource protection.

Tables
Picnic tables are not permissible.

Toilets
Toilet facilities are limited to locations where there are health and sanitation problems or serious resource damage, and where reducing or dispersing visitor use is not practical or realistic.

PLAQUES, MEMORIALS, AND BURIAL PLOTS

Existing commemorative features and burial plots may be retained. No future additions may be made, unless permitted by existing reservations.

APPENDIX C

Public Law 93-620
93rd Congress, S. 1296
January 3, 1975

An Act

To further protect the outstanding scenic, natural, and scientific values of the Grand Canyon by enlarging the Grand Canyon National Park in the State of Arizona, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

Grand Canyon National Park Enlargement Act.

SHORT TITLE

SECTION 1. This Act may be cited as the "Grand Canyon National Park Enlargement Act". 16 USC 228a note.

DECLARATION OF POLICY

SEC. 2. It is the object of this Act to provide for the recognition by Congress that the entire Grand Canyon, from the mouth of the Paria River to the Grand Wash Cliffs, including tributary side canyons and surrounding plateaus, is a natural feature of national and international significance. Congress therefore recognizes the need for, and in this Act provides for, the further protection and interpretation of the Grand Canyon in accordance with its true significance. 16 USC 228a. 88 STAT. 2089 88 STAT. 2090

ENLARGEMENT OF GRAND CANYON NATIONAL PARK BOUNDARIES

SEC. 3. (a) In order to add to the Grand Canyon National Park certain prime portions of the canyon area possessing unique natural, scientific, and scenic values, the Grand Canyon National Park shall comprise, subject to any valid existing rights under the Navajo Boundary Act of 1934, all those lands, waters, and interests therein, constituting approximately one million two hundred thousand acres, located within the boundaries as depicted on the drawing entitled "Boundary Map, Grand Canyon National Park," numbered 113–20, 021 B and dated December 1974, a copy of which shall be on file and available for public inspection in the offices of the National Park Service, Department of the Interior. 16 USC 228b. 48 Stat. 960.

(b) For purposes of this Act, the Grand Canyon National Monument and the Marble Canyon National Monument are abolished. Abolishment.

(c) The Secretary of the Interior shall study the lands within the former boundaries of the Grand Canyon National Monument commonly known as the Tuckup Point, Slide Mountain, and Jensen Tank areas to determine whether any portion of these lands might be unsuitable for park purposes and whether in his judgment the public interest might be better served if they were deleted from the Grand Canyon National Park. The Secretary shall report his findings and recommendations to the Congress no later than one year from the date of enactment of this Act. Study. Report to Congress.

ACQUISITION OF LANDS BY DONATION OR EXCHANGE

SEC. 4. (a) Within the boundaries of the Grand Canyon National Park, as enlarged by this Act, the Secretary of the Interior (hereinafter referred to as the "Secretary") may acquire land and interest in land by donation, purchase with donated or appropriated funds, or exchange. 16 USC 228c.

(b) Federal lands within the boundaries of such park are hereby transferred to the jurisdiction of the Secretary for the purposes of this Act.

PROHIBITION AGAINST TAKING OF STATE OR INDIAN LANDS

16 USC 228d.

SEC. 5. Notwithstanding any other provision of this Act (1) land or interest in land owned by the State of Arizona or any political subdivision thereof may be acquired by the Secretary under this Act only by donation or exchange and (2) no land or interest in land, which is held in trust for any Indian tribe or nation, may be transferred to the United States under this Act or for purposes of this Act except after approval by the governing body of the respective Indian tribe or nation.

COOPERATIVE AGREEMENTS FOR UNIFIED INTERPRETATION OF GRAND CANYON

16 USC 228e.

SEC. 6. In the administration of the Grand Canyon National Park, as enlarged by this Act, the Secretary is authorized and encouraged to enter into cooperative agreements with other Federal, State, and local public departments and agencies and with interested Indian tribes providing for the protection and interpretation of the Grand Canyon in its entirety. Such agreements shall include, but not be limited to, authority for the Secretary to develop and operate interpretative facilities and programs on lands and waters outside of the boundaries of such park, with the concurrence of the owner or administrator thereof, to the end that there will be a unified interpretation of the entire Grand Canyon.

88 STAT. 2090
88 STAT. 2091

PRESERVATION OF EXISTING GRAZING RIGHTS

16 USC 228f.

SEC. 7. Where any Federal lands within the Grand Canyon National Park, as enlarged by this Act, are legally occupied or utilized on the effective date of this Act for grazing purposes, pursuant to a Federal lease, permit, or license, the Secretary shall permit the persons holding such grazing privileges to continue in the exercise thereof during the term of the lease, permit, or license, and periods of renewal thereafter: *Provided*, That no such renewals shall be extended beyond the period ending ten years from the date of enactment of this Act, except that any present lease, permit, or license within the boundaries of the Grand Canyon National Monument as abolished by subsection 3(b) of this Act may be renewed during the life of the present holder which renewals shall terminate upon the death of the present holder.

AIRCRAFT REGULATION

16 USC 228g.

SEC. 8. Whenever the Secretary has reason to believe that any aircraft or helicopter activity or operation may be occurring or about to occur within the Grand Canyon National Park, as enlarged by this Act, including the airspace below the rims of the canyon, which is likely to cause an injury to the health, welfare, or safety of visitors to the park or to cause a significant adverse effect on the natural quiet and experience of the park, the Secretary shall submit to the Federal Aviation Agency, the Environmental Protection Agency pursuant to the Noise Control Act of 1972, or any other responsible agency or agencies such complaints, information, or recommendations for rules and regulations or other actions as he believes appropriate to protect the public health, welfare, and safety or the natural environment within the park. After reviewing the submission of the Secretary, the responsible agency shall consider the matter, and after consultation with the Secretary, shall take appropriate action to protect the park and visitors.

42 USC 4901 note.

PRESERVATION OF EXISTING RECLAMATION PROVISIONS

SEC. 9. (a) Nothing in this Act shall be construed to alter, amend, repeal, modify, or be in conflict with the provisions of sections 601 to 606 of the Colorado River Basin Project Act, approved September 30, 1968 (82 Stat. 885, 901). 16 USC 228h. 43 USC 1551-1556.

(b) Section 7 of the Act of February 26, 1919 (40 Stat. 1175, 1178), is amended to read as follows: 16 USC 227.

"Whenever consistent with the primary purposes of such park, the Secretary of the Interior is authorized to permit the utilization of those areas formerly within the Lake Mead National Recreation Area immediately prior to enactment of the Grand Canyon National Park Enlargement Act, and added to the park by such Act, which may be necessary for the development and maintenance of a Government reclamation project."

HAVASUPAI INDIAN RESERVATION

SEC. 10. (a) For the purpose of enabling the tribe of Indians known as the Havasupai Indians of Arizona (hereinafter referred to as the "tribe") to improve the social, cultural, and economic life of its members, the lands generally depicted as the "Havasupai Reservation Addition" on the map described in section 3 of this Act, and consisting of approximately one hundred and eighty-five thousand acres of land and any improvements thereon, are hereby declared to be held by the United States in trust for the Havasupai Tribe. Such map, which shall delineate a boundary line generally one-fourth of a mile from the rim of the outer gorge of the Grand Canyon of the Colorado River and shall traverse Havasu Creek from a point on the rim at Yumtheska Point to Beaver Falls to a point on the rim at Ukwalla Point, shall be on file and available for public inspection in the Offices of the Secretary, Department of the Interior, Washington, District of Columbia. 16 USC 228i. 88 STAT. 2091 88 STAT. 2092

(b) The lands held in trust pursuant to this section shall be included in the Havasupai Reservation, and shall be administered under the laws and regulations applicable to other trust Indian lands: *Provided*, That— Administration.

(1) the lands may be used for traditional purposes, including religious purposes and the gathering of, or hunting for, wild or native foods, materials for paints and medicines;

(2) the lands shall be available for use by the Havasupai Tribe for agricultural and grazing purposes, subject to the ability of such lands to sustain such use as determined by the Secretary;

(3) any areas historically used as burial grounds may continue to be so used;

(4) a study shall be made by the Secretary, in consultation with the Havasupai Tribal Council, to develop a plan for the use of this land by the tribe which shall include the selection of areas which may be used for residential, educational, and other community purposes for members of the tribe and which shall not be inconsistent with, or detract from, park uses and values; *Provided further*, That before being implemented by the Secretary, such plan shall be made available through his offices for public review and comment, shall be subject to public hearings, and shall be transmitted, together with a complete transcript of the hearings, at least 90 days prior to implementation, to the Committees on Interior and Insular Affairs of the United States Congress; Study. Plan and transcript, transmittal to congressional committees.

and *Provided further*, that any subsequent revisions of this plan shall be subject to the same procedures as set forth in this paragraph;

Commercial industries, restrictions.

(5) no commercial timber production, no commercial mining or mineral production, and no commercial or industrial development shall be permitted on such lands: *Provided further*, That the Secretary may authorize the establishment of such tribal small business enterprises as he deems advisable to meet the needs of the tribe which are in accordance with the plan provided in paragraph (4) of this section;

Nonmembers, privileges.

(6) nonmembers of the tribe shall be permitted to have access across such lands at locations established by the Secretary in consultation with the Tribal Council in order to visit adjacent parklands, and with the consent of the tribe, may be permitted (i) to enter and temporarily utilize lands within the reservation in accordance with the approved land use plan described in paragraph (4) of this section for recreation purposes or (ii) to purchase licenses from the tribe to hunt on reservation lands subject to limitations and regulations imposed by the Secretary of the Interior; and

(7) except for the uses permitted in paragraphs 1 through 6 of this section, the lands hereby transferred to the tribe shall remain

88 STAT. 2092

forever wild and no uses shall be permitted under the plan which

88 STAT. 2093

detract from the existing scenic and natural values of such lands.

Conservation measures.

(c) The Secretary shall be responsible for the establishment and maintenance of conservation measures for these lands, including, without limitation, protection from fire, disease, insects, or trespass and reasonable prevention or elimination of erosion, damaging land use, overgrazing, or pollution. The Secretary of the Interior is authorized to contract with the Secretary of Agriculture for any services or materials deemed necessary to institute or carry out any such measures. Any authorized Federal programs available to any other Indian tribes to enhance their social, cultural, and economic well-being shall be deemed available to the tribe on these lands so long as such programs or projects are consistent with the purposes of this Act. For these purposes, and for the purpose of managing and preserving the resources of the Grand Canyon National Park, the Secretary shall have the right of access to any lands hereby included in the Havasupai Reservation. Nothing in this Act shall be construed to prohibit access by any members of the tribe to any sacred or religious places or burial grounds, native foods, paints, materials, and medicines located on public lands not otherwise covered in this Act.

"Raintank Allotment", grazing rights.

(d) The Secretary shall permit any person presently exercising grazing privileges pursuant to Federal permit or lease in that part of the Kaibab National Forest designated as the "Raintank Allotment", and which is included in the Havasupai Reservation by this section, to continue in the exercise thereof, but no permit or renewal shall be extended beyond the period ending ten years from the date of enactment of this Act, at which time all rights of use and occupancy of the lands will be transferred to the tribe subject to the same terms and conditions as the other lands included in the reservation in paragraph (b) of this section.

"Havasupai Use Lands", use.

(e) The Secretary, subject to such reasonable regulations as he may prescribe to protect the scenic, natural, and wildlife values thereof, shall permit the tribe to use lands within the Grand Canyon National Park which are designated as "Havasupai Use Lands" on the Grand

Canyon National Park boundary map described in section 3 of this Act, and consisting of approximately ninety-five thousand three hundred acres of land, for grazing and other traditional purposes.

(f) By the enactment of this Act, the Congress recognizes and declares that all right, title, and interest in any lands not otherwise declared to be held in trust for the Havasupai Tribe or otherwise covered by this Act is extinguished. Section 3 of the Act of February 26, 1919 (40 Stat. 1177; 16 U.S.C. 223), is hereby repealed. Repeal.

AUTHORIZATION OF APPROPRIATIONS

SEC. 11. There are authorized to be appropriated such sums as may be necessary to carry out the provisions of this Act, not to exceed, however, $1,250,000, in the aggregate for the period of the five fiscal years beginning with the fiscal year ending June 30, 1074, for the acquisition of lands and property, and not to exceed $49,000 for the fiscal year ending June 30, 1974, $255,000 for the fiscal year ending June 30, 1975, $265,000 for the fiscal year ending June 30, 1976, and $235,000 for the fiscal year ending June 30, 1977, for development, plus or minus such amounts, if any, as may be justified by reason of ordinary fluctuations in construction costs as indicated by engineering cost indexes applicable to the types of construction involved herein. The sums authorized in this section shall be available for acquisition and development undertaken subsequent to the date of enactment of this Act. 16 USC 228j.

Approved January 3, 1975.

LEGISLATIVE HISTORY:

HOUSE REPORTS: No. 93-1374 (Comm. on Interior and Insular Affairs) and No. 93-1611 (Comm. of Conference).
SENATE REPORT No. 93-406 (Comm. on Interior and Insular Affairs).
CONGRESSIONAL RECORD:
Vol. 119 (1973): Sept. 24, considered and passed Senate.
Vol. 120 (1974): Oct. 10, considered and passed House, amended.
Dec. 18, House and Senate agreed to conference report.

APPENDIX D

GEOLOGIC HISTORY OF GRAND CANYON

The Early Precambrian, Vishnu Schist is the oldest rock formation exposed within Grand Canyon. It consists of 25,000 feet of fine-grained sedimentary rock and 12,000 to 15,000 feet of lava flows, both of which have been metamorphosed into gneiss and schist. In general, the fine-grained clastic rocks of the Vishnu are believed to have accumulated in the relatively shallow waters of an epicontinental sea. The floor of this sea slowly subsided and an enormous thickness of rather monotonous sands and shales were deposited. The apparent thickness of the fine clayey sands exceeds 25,000 feet, but it is not known how much this has been increased by repitition through folding and by injection of granitic material or decreased by compression, recrystallization, and flowage. Considerable quantities of calcite found in some places are interpreted as having been calcareous concretions.

Volcanic activity increased during the later stages of Vishnu time, and basaltic lava flows poured into the ancient sea floor. The basalts were later metamorphosed into schists, and layers of sand and silt between the flows were changed into quartzite and quartz mica schist.

The Vishnu Schist is suspended, as it were, in the roof of a much younger batholith of granite, which invaded it in a molten condition. This granite has a radiometric age determination of 1,720 million years, so the older Vishnu may prove to be over 2,000 million years old or older. No traces of life have been found in these ancient metamorphosed rocks.

STRATIGRAPHIC FORMATIONS -- GRAND CANYON NATIONAL PARK

CENOZOIC

Slumps, landslides and rockfalls

Terrace gravels; loose sand and conglomerate

River deposits; Recent sand, boulders and mud

Travertine deposits

Unconformity

MESOZOIC — TRIASSIC

Shinarump Conglomerate

Unconformity

Moenkopi Formation

Unconformity

PALEOZOIC — PERMIAN

Kaibab Limestone

Unconformity

Toroweap Formation

Coconino Sandstone; sharp level contact with Toroweap Formation and Hermit Shale

Hermit Shale

Unconformity

PALEOZOIC — PENNSYLVANIAN — SUPAI GROUP

Esplanade Sandstone

Unconformity

Wescogame Formation

Unconformity

Manakacha Formation

Unconformity

Watahomigi Formation

Unconformity

PALEOZOIC — MISSISSIPPIAN

Redwall Limestone

Unconformity

PALEOZOIC — DEVONIAN

Temple Butte Limestone; local channel filling only in the Kwagunt, Nankoweap and Marble Canyon areas

Unconformity

PALEOZOIC — CAMBRIAN

Muav Limestone; includes Cambrian undifferentiated rocks in upper part of formation

Bright Angel Shale; gradational contacts with Muav Limestone and Tapeats Sandstone

Tapeats Sandstone

Great Unconformity

YOUNGER PRECAMBRIAN — CHUAR GROUP

Sixtymile Formation

Unconformity

Kwagunt Formation; includes Walcott, Awatubi and Carbon Butte Members

Galeros Formation; includes Duppa, Carbon Canyon, Jupiter and Tanner Members

Unconformity

Nankoweap Formation

Unconformity

YOUNGER PRECAMBRIAN — UNKAR GROUP

Cardenas Lavas; basalt lave flows with interbedded sandstones

Diabase intrusives; sills and dikes

Dox Sandstone

Shinumo Quartzite

Hakatai Shale

Bass Formation; includes Hotauta Conglomerate Member

Unconformity

OLDER PRECAMBRIAN — ZORASTER PLUTONIC COMPLEX

Directionless to foliated granitic plutons of intrusive igneous origin. The Complex also includes pegmatite/aplite dikes and sills, indicated by hachure overprint. (See under Vishnu Group.)

Granite to granodiorite, relatively poor in mafic minerals.

Granodiorite to quartz diorite and rarely diorite, relatively rich in mafic minerals.

OLDER PRECAMBRIAN — TRINITY AND ELVES CHASM GNEISSES

Predominantly granodioritic to quartz dioritic gneisses containing sparse interlayers of Vishnu material.

Elves Chasm Gneiss

Trinity Gneiss

OLDER PRECAMBRIAN — VISHNU GROUP

Metasedimentary and mafic metaigneous rocks.

Predominantly mica schist and quartzo-feldspathic schist, with minor units of para-gneiss, amphibolite and calc-silicate.

Predominantly amphibolite.

Predominantly calc-silicate rock.

The long, long episode of sedimentation and volcanism was ended by uplift, compression, and mountain-building on a grand scale - the Mazatzal Revolution. Folding and recrystallization under pressure (metamorphism) profoundly changed the attitude and constitution of the rocks previously accumulated. The Vishnu strata and flows in the Bright Angel Canyon area were folded tightly into a huge geosyncline. Under heat and pressure, recrystallization of the less stable minerals occurred and their directions of easiest growth were oriented in a general northeast-southwest direction more or less parallel to the original bedding planes of the sediments and flow lines of the lavas.

The invasion of the Zoroaster Granite began sometime after deformation and perhaps during later phases of the regional metamorphism and mountain-building. It is a coarse-grained granite of reddish color. Not only was granitic material injected as a melt, but granitic materials were introduced by permeating gases and schists were granitized. The last episode of intrusion produced sills and dikes of pegmatite and aplite, and was probably a hydrothermal event. New minerals resulting from contact metamorphism were added to the original mineral assemblages and to their recrystallized regional metamorphic derivatives. The mountains were probably as high as the modern Himalayas or Andes.

The last episode of the Early Precambrian was a long interval of erosion which developed the Arizonan Plain or Ep-Archean erosion surface. The high mountains which had dominated the landscape were worn away by streams and other forces of erosion until a nearly level plain remained. In the Grand Canyon, this surface has a relief not exceeding 20 feet in most areas, and an observed maximum of 50 feet.

A long time elapsed after the conclusion of the Mazatzal Revolution, and before the first Late Precambrian sedimentation began. Inasmuch as there are no rocks representative of this time, it represents a gap in our knowledge of the geologic history of this area. Faulting and fracturing initiated during the Mazatzal Orogeny continued after the cooling of the Zoroaster Granite.

The Unkar Group includes all of the lower, Late Precambrain rocks found in the Grand Canyon region. The Unkar Group has a cumulative thickness of over 5,000 feet. Here and there on the Arizonan Plain up to 50 of the basal Hotauta Conglomerate was deposited. It incorporates angular and sub-angular fragments of quartzite, quartz, granite, and other inundated rocks of the Arizona Plain.

A sea encroached upon the desert plain from the west, removing soil and interstream ridges by wave action and marine abrasion as it advanced. The surface upon which this sea began to lay down its deposits was amazingly flat. It possessed a maximum local relief of 20 to 50 feet. In remnants found over an area that perhaps exceeds 1,000 square miles, the relief is scarcely discernable. No other surface of erosion of such an extent has been reported in the world. The Bass Limestone was the first sea deposit to be laid down upon this nearly level surface. It is dominantly composed of gray dolomites which are dark brown on weathered surfaces. Interbedded shales and sandstone in the upper part, some with ripple marks, indicate fluctuating shallow water as their condition of deposition. The formation is about 200 feet thick in the canyon below Grand Canyon Village where it forms a cliff on exposure. Stromatolites and algal filaments found in this formation indicate the existence of

primitive forms of life. The age of the Bass Limestone is 1100-1600 million years.

The Hakatai Shale overlies the Bass Limestone and consists of some 800 feet of reddish and vermillion mudstone and shales with some sandstones. It is the most vividly colored formation of Grand Canyon. An outcrop north of Pipe Creek may easily be seen from the South Rim. Ripple marks, mud cracks, and raindrop imprints are fairly common. Cubical impressions on upper surfaces of beds may be molds of salt crystals. All these features indicate that the Hakatai was deposited as a mud flat under shallow water conditions with occasional emergence. A period of erosion followed the deposition of the Hakatai. The formation generally erodes to a smooth slope.

The Rama Intrusives are plugs, dikes, and sills of basalt and diabase which have been intruded into the Bass Limestone and the Hakatai Shale. A 240-foot-thick sill occurs in the Hakatai Shale of Bright Angel Canyon, and is also exposed in Hindu Amphitheater. There is no known connection between the Rama Intrusives and the later volcanics of the Cardenas Formation.

The Shinumo Quartzite consists of thick-bedded to massive white, purple, red, and brown sandstones and subarkosic strata which grade into cemented quartzites. The formation is about 1,100 to 1,400 feet thick. Many outcrops are cross-bedded and some show ripple marks. They were deposited under rather uniform, nearshore shallow water conditions. Where exposed, the Shinumo stands in imposing cliffs.

The Dox Formation (1,700 to 3,000 feet thick) consists largely of reddish-brown sandstones and calcareous sandstones with some green, white, and buff beds. There are some interbedded shales and siltstones. Ripple marks and cross-bedding indicate shallow water deposition. The basal part of the formation is a delta front, the next beds are the interdistributory flood plain deposits of a coastal alluvial plain, and the upper portions are tidal flat deposits. Where exposed, it stands in steep cliffs and slopes.

The Cardenas Formation consists of at least 13 lava flows interbedded with eight very fine-grained sandstone beds. Characteristics of the lavas and sandstone beds suggest deposition in standing water that became shallower with time and intermittently disappeared altogether. The shallow water environment was maintained by basin subsidence or rising water level, or both, during accumulation of the lava flows and sandstones in the hypersaline water of the Dox Sea. Radiometric dates of 845 ± 15 and 1,150 ± 30 million years have been obtained from lavas in this formation and paleomagnetic pole positions indicate an age range of from 1,000 to 1,200 million years. The formation is nearly 1,100 feet thick in the eastern Grand Canyon. A 70-foot-thick sill of probable Cardenas age is found in the upper part of the Shinumo Quartzite in Bright Angel Canyon.

The Nankoweap Group overlies the Unkar Group and is more properly considered a formation which consists dominantly of sandstone. It is separated from both overlying and underlying formations by unconformities. It is found only in the eastern Grand Canyon where it reaches a maximum thickness of 330 feet.

The youngest Precambrian rocks of the Grand Canyon region are found overlying strata of the Nankoweap and Unkar Groups in the eastern part of the park, and are referred to as the Chuar Group. These formations were elevated as fault block mountains and then eroded from most of the area while the Ep-Algonkian or Grand Canyon Peneplain was being formed.

At the base of the Chuar Group is the Galeros Formation. It consists of some 40-80 feet of massive, coarsely crystalline dolomite at the base, with 580 feet of predominantly shale strata above.

The Kwagunt Formation is the middle member of the Chuar Group. It is 1,200 feet thick and consists primarily of shales and mudstones with interbedded, thin limestones and dolomites. The basal 80 feet of this formation is a red sandstone unit which is very prominent on Carbon Butte in the eastern Grand Canyon.

The Sixty Mile Formation is the upper member of the Chuar Group and is mainly composed of breccias and coarse, pebbly sandstones, with subordinate cherty siltstones. It is only 120 feet thick, but its breccias suggest tectonic uplift with erosion of the surrounding outcrops of younger formations in the Chuar Group due to slight warping.

Following the deposition of the Late Precambrian Chuar strata, the Grand Canyon area was subjected to stresses reviving earlier faults and leading to the elevation of block faulted mountains similar to those now seen in the Basin and Range section of western America. This period of mountain-building is called the Grand Canyon Revolution.

The uplifted block-faulted mountains were then subjected to a long period of subaerial erosion. This erosion produced the Ep-Algonkian erosion surface which, although often referred to as the Grand Canyon Peneplain, actually consists of a series of block-faulted, quartzite ridges, some of which rise 800 to 900 feet above the general base of erosion.

Rocks of the Paleozoic Era began being deposited in Middle Cambrian time in Grand Canyon. The Grand Canyon Peneplain was slowly submerged beneath a sea encroaching from the west. Here and there, thin basal conglomerates, arkoses, and quartzite breccias deposited as surface debris were reworked by the waves. Then thick, cross-bedded, brown sandstones were deposited. The monadnocks of the Grand Canyon Peneplain projected above the water as islands until successively covered by Tapeats and later sediments. The Tapeats Sandstone averages about 200 feet thick below Grand Canyon Village.

The Bright Angel Shale was deposited on top of the Tapeats Sandstone and grades into thin-bedded sandstones and greenish to buff micaceous shales. Most of the dolomite beds, which weather to a brownish color, occur in the upper part of the formation. During the last part of Bright Angel time the last of the Cambrian islands were buried. The Bright Angel Formation is generally 350-400 feet thick below Grand Canyon Village. Trilobites, small extinct marine crustaceans, are the characteristic fossils. Some primitive brachiopods are also found. The Bright Angel represents an intermediate stage in the west to east transgression of the Cambrian sea.

The Muav Limestone consists largely of gray and buff limestone. The base has layers of impure, mottled limestone interbedded with greenish shale

and buff sandstone, lithologically similar to the Bright Angel Formation from which it is transitional. The top of the formation consists of brown shales and sandstones. It varies in thickness from 300 to 400 feet below Grand Canyon Village. Trilobites and brachiopods are the characteristic fossils. The Muav Limestone was deposited well offshore as the Cambrian sea advanced from west to east across the Grand Canyon Region.

No beds of certain Ordovician or Silurian age have been found in Grand Canyon National Park. They either were never deposited or were removed by erosion since deposition. An undulating dolomite overlies the Muav Limestone in the western Grand Canyon near the Hurricane Fault. Fossil evidence is yet lacking but this formation may prove to be Ordovician or Silurian in age.

Hollows and channels eroded in the top of the Muav Limestone are filled with a calcareous sandstone and a lavender to purplish colored dolomitic limestone. These outcrops of the Devonian Temple Butte Limestone are usually found in cliff faces. Scales from an extinct armored fish have been found in this formation, as well as corals, brachiopods, and gastropods. Nearly all of the remnant outcrops of this formation are less than 100 feet thick in the eastern Grand Canyon. In the middle portion of the Grand Canyon, the Temple Butte Limestone is several hundred feet thick and everywhere separates the Muav Limestone from the Redwall Limestone. The formation becomes progressively thicker to the west and, toward the lower end of Grand Canyon, it attains a maximum thickness of more than 1,000 feet. This difference in thickness is primarily due to erosion in Late Devonian and Early Mississippian time.

The Mississippian Redwall Limestone consists of thick to massively bedded, bluish-gray limestone beds. Various horizons contain irregular white chert nodules. The formation averages 500 feet in thickness below Grand Canyon Village and forms the major part of a cliff generally 600 feet high. It is the most conspicuous cliff above the Tonto Rim. The prevailing red color is a surface feature only, an iron oxide painted over it by rainwash from the overlying Supai redbeds. Various marine invertebrates, including brachiopods, corals, and crinoids, are the characteristic fossils found in this formation.

During a period of erosion following Redwall deposition, caves, solution hollows, cavities, and fissures (karst topography) were eroded in the Redwall Limestone. Erosion probably began in Mississippian time and extended into the Pennsylvanian Period.

The Supai Formation was deposited in Late Pennsylvanian and Early Permian time. It is a thick (1,000-foot) series of alternating red cross-bedded sandstones and shales. The lower fourth of the formation, which includes calcareous sandstones and limestones, may be marine in origin and is Pennsylvanian in age. The upper part, the bulk of the formation, is probably Permian, as is the overlying Hermit Shale. It is nonmarine, and on bedding plane surfaces trails of quadrupeds are found. Some of the footprints indicate that the animals making them were the size of small lizards. Some larger tracks, 2-3 inches across, were made by heavier and probably more sluggish creatures. The animals are believed to have been either amphibians or primitive reptiles.

The Permian Hermit Shale is 100-300 feet in thickness, and is a deep red color. The strata are mostly shales and siltstones with a few lenticular sandstones near the base. The red color resulting from iron oxide, mud cracks, and ripple marks, indicates shallow water conditions and intermittent exposure to air. Thirty-five species of fossil plants, mostly ferns, have been described from the Hermit. There are also quadrupedal footprints on some of the bedding planes.

The Coconino Sandstone is a massive, white to buff, corss-bedded sandstone and is 400 feet thick below Grand Canyon Village. It is a rather pure, uniformly fine-grained quartz sandstone. The grains are rounded and commonly pitted and frosted. Eolian cross-bedding on a large scale is characteristic. The formation was accumulated in a huge desert sand dune area. Trails of quadrupedal animals, small primitive reptiles or amphibians, have been found on cross-bedded surfaces.

The Toroweap Formation, deposited by the Toroweap sea, includes red and yellowish sandstones at top and bottom with intermediate gray limestones. The Toroweap sea spread over the Coconino dune area from the northwest while the sand was still fairly loose. The formation is about 290 feet thick below Grand Canyon Village.

The Toroweap sea retreated westward from the Grand Canyon region, and then returned as the Kaibab sea, advancing across the Grand Canyon region from west to east.

The Kaibab Limestone is composed of massive, marine limestones. They form the uppermost cliff along the rim. Some of the beds contain admixtures

of sand and nodules of white chert. Bedded cherts also occur. Where erosion has not removed the uppermost beds near the rim, it measures 320 feet in thickness. The Kaibab has a rather abundant marine fauna of brachiopods, corals, cephalopods, crinoids, and sponges. After withdrawal of the Kaibab sea, there followed a period of arid erosion. No mountain-building or even slight deformation affected the thick succession of Paleozoic strata. Broad shallow valleys were cut, but nowhere did the downcutting continue long enough to remove much of the upper part of the Kaibab Formation. Some karst erosion took place at the end of the Permian or near the beginning of the Triassic.

The presence of an erosion surface at the top of the Kaibab rimrock of the Grand Canyon indicates that the land surface was above sea level at the beginning of the Mesozoic Era. Erosion has removed most of the Triassic Moenkopi Formation and almost all of the more recent Mesozoic and Cenozoic rocks from the Grand Canyon region. Their prior existence over the canyon's strata can only be extablished through inference and extrapolation from outcrops in nearby areas.

The Moenkopi Formation is found both immediately east and south of the park. It consists of 500-600 feet of continental, red to chocolate brown shales, siltstones, mudstones, and sandstones. It also contains thin beds of yellowish to greenish limestones and some gypsum. The fossil fauna includes plants, reptiles, amphibians, and fish. Cedar Mountain, just east of Desert View, is an erosional remnant of Moenkopi capped by Shinarump Conglomerate. Red Butte, 15 miles south of Grand Canyon Village, is composed of Moenkopi and Chinle strata and is capped by a 150-foot-thick flow of Pliocene basalt.

The basal member of the Chinle Formation is the Shinarump Conglomerate. Regional upwarping had ended the deposition of the Moenkopi Formation and caused a general withdrawal of the Triassic seas. Recurrent uplift along the Mogollon Highlands formed a generally northwestward-flowing drainage system. At first, streams cut valleys and large channels, and then later began to aggrade and deposit the conglomeritic and sandy sediments of the basal members of the Chinle Formation followed by the upper layers of siltstone, claystone, and thin sandstones. These fluviatile deposits contain large quantities of petrified wood and form the Painted Desert between Cameron and Tuba City, Arizona.

The reddish-orange, parallel-bedded siltstones of the Wingate Sandstone were apparently not deposited in the Grand Canyon area. This formation is very prominent in Navajo Country, but is absent in the Echo Cliffs east of Marble Canyon.

The Jurassic Period was ushered in by the fluvial and small lake deposits of the Moenave Formation. The basal Dinosaur Canyon member is a moderate reddish-orange sandstone which conformably overlies the Chinle Formation. The upper Springdale Sandstone member is a pale reddish-brown, fine to medium grained, cross-bedded sandstone. Primitive crocodile fossil remains indicate a tropical to sub-tropical climate in this area at that time. The original thickness in the Grand Canyon area would be probably less than 100 feet.

The Kayenta Formation east of Grand Canyon consists of approximately 500 feet of variegated sandstones and mudstones formed in marshes and

in dune areas. The overlying Navajo Sandstone is a massive, cross-bedded, pale reddish-brown to pale orange, medium-grained sandstone. It is primarily a sand dune deposit.

The Carmel Formation and the Entrada Sandstone are undifferentiated just to the east of the Grand Canyon. The strata consist of friable white cross-bedded and flat-bedded sandstone banded by a few thin beds of rust-colored siltstone. Total thickness is between 200 and 300 feet. The deposits indicate fluviatile and shallow water deposition. The strata lie uncomformably on the beveled tops of the Navajo Sandstone dunes.

The Cow Springs Formation is a massive, greenish-gray to yellowish-gray, fine-grained, cross-bedded sandstone. Its thickness to the east of Grand Canyon is approximately 350 feet. It is an eolian deposit and may be mistaken for the Navajo Sandstone which it closely resembles.

Epirogenic uplift to the south and southwest of the canyon area marked the end of the Jurassic Period and the beginning of the rocks in northern Arizona and produced a gently rolling and channeled landscape. The Dakota Sandstone represents the initial transgression of the Late Cretaceous sea into the Grand Canyon area from the east. It consists of a lower, fluvial sandstone, a middle carbonaceous member of lagoonal origin, and an upper shallow marine sandstone. The formation is approximately 100 feet thick east of Grand Canyon.

The Mancos Shale is mostly banded, light to medium gray shales with some yellowish-grays in the sandier parts. Its thickness to the east of Grand Canyon is 400-500 feet. The overlying Toreva Formation consists of a

basal, cliff-forming sandstone member, a middle slope-forming carbonaceous member, and an upper cliff-forming sandstone member. Above this, the Wepo Formation comprises a series of intercalated siltstones, mudstones, sandstones, and coal. The siltstone and mudstone units are dark olive-gray to olive-brown. The Straight Cliffs Sandstone of the Kaiparowits Basin is correlative with the Toreva and Wepo Formations. It is a massive, fine- to medium-grained sandstone with some coal and carbonaceous shale in the middle part.

The marine, nearshore Wahweap Sandstone outcrops in the Lake Powell/Kaiparowits region and consists of alternating sandstone and shale in the lower part, and massive resistant sandstone in the upper part. Westward, it grades into fluvial siltstones and shales.

Uncomformably overlying the Wahweap is the Kaiparowits Formation, composed of thin-bedded sandstone with subordinate amounts of calcareous siltstone, limestone, and conglomerate. This formation was deposited in streams and freshwater lakes and ponds in a tropical climate.

The Canaan Peak Formation is mostly a pebble-cobble conglomerate and conglomeratic sandstone containing a few interbedded mudstones. It lies uncomformably on the Kaiparowits Formation and ranges from 0 to 1,000 feet in thickness. The initial movement of the Kaibab Uplift probably began during the deposition of this formation. The conglomerates were derived from western sources.

Regional uplift, tilting and structural development related to the Laramide Orogeny began perhaps as early as just before the deposition of the

Kaiparowits Formation and was certainly underway by the end of Kaiparowits time.

At the close of the Cretaceous, the dominant regional drainage direction was east and northeast across the large flood plain that was northeastern Arizona. A blanket of Mesozoic rocks as thick as 4,000 to 8,000 feet had been deposited over the top of the Kaibab Limestone as the land surface gradually sank. The subsidence was interrupted by short periods of erosion indicating that the land surface remained very close to sea level. This Mesozoic subsidence took place on a very large scale that involved most of the Colorado Plateau. Gentle regional warping of the Paleozoic rocks may have occurred during this period, but faulting and intense folding did not occur in the Grand Canyon region. At the beginning of the Cenozoic Era, the Kaibab Limestone which forms the present rim of Grand Canyon was more than 4,000 feet <u>below</u> sea level - more than 2 miles below its present elevation.

The quiescence of 500 million years of Paleozoic and Mesozoic rule abruptly came to an end with the advent of the Cenozoic Era and the Laramide Revolution. The Laramide Revolution was a series of orogenies that caused worldwide structural deformation. The Colorado Plateau was not exempt from this deformation and was affected throughout most of Paleocene and early Eocene time (between 50 and 60 million years ago).

Strong, eastward-directed, compressive forces created north trending folds and monoclines such as the East Kaibab Monocline, which bounds the Kaibab Plateau on the eastern side of the park. The Colorado Plateau was generally uplifted in Laramide time, perhaps as much as three-quarters of

a mile above sea level. This drained the seas from the region and initiated a major erosion cycle that is continuing to this day. The uplift of the Plateau was not uniform; instead, the surface rose in gentle swales and arches which were terminated at their margins by north-south structural zones. The anticlinal Kaibab Uplift and many other broad-scale features began during this period of uplift.

Following the Laramide Revolution, the Colorado Plateau stabilized in an elevated position and its surface underwent vigorous erosion. The land surface in the Grand Canyon area was beveled and most of the Cretaceous, Jurassic and Triassic formations were stripped away. Early Cenozoic sediments accumulated in adjacent areas, but little definite record remains of Early Cenozoic sedimentation on the Grand Canyon section of the Colorado Plateau.

North of the Grand Canyon, the Pine Hollow Formation is of Paleocene (?) age and is predominately red to purplish-gray mudstone, calcareous mudstone, or very fine-grained clastic limestone. It is generally conformable on, and locally intertongues with, the Canaan Peak Formation in southern Utah. However, in places it appears to lie on an irregular, low-relief surface formed on the Canaan Peak Formation.

The Wasatch (Claron) Formation consists of a lower pink fine-grained limestone member about 800 feet thick, a middle white limestone member about 550 feet thick, and an upper variegated sandstone member which is 300 to 600 feet thick. The lower part of the Wasatch Formation is probably Paleocene, and early to middle Eocene freshwater mollusks have been found in the middle member. The Wasatch uncomformably overlies

older formations involved in the folding of the East Kaibab Monocline to form the Kaibab Uplift. The Wasatch was not deformed by this uplift and thus indicates that the movement occurred prior to its deposition.

Igneous intrusive activity began in southern Utah during the Oligocene. In the Aquarius Plateau the Wasatch Formation is overlain by several hundred feet of white tuffaceous sandstone, volcanic breccia, and latite welded tuff, which is believed to be of Oligocene age as it is in turn overlain by the Tuff of Osiris, which has been radiometrically dated as early Miocene. Uplift began during the Oligocene in the Central Arizona Mountain area. The Kaibab Plateau would not have stood as a barrier to east- or west-flowing streams. The eolian Chuska Sandstone in the eastern Navajo Reservation may be partially or wholly Oligocene in age.

The Ancestral Little Colorado River had excavated a large valley to the east of Grand Canyon by Miocene time. Paleozoic and Precambrian gravels were being washed north across the present trace of the Grand Canyon from the uplifted Central Arizona Mountains. The volcanic Peach Spring Tuff was emplaced in Peach Springs Canyon some 18 million years ago and effectively blocked any large river from exiting through this canyon from the Grand Canyon area. By 14 million years ago, the broad valley drained by the present Cataract Creek had been excavated and stream and shallow lake deposits were covered by basaltic lavas from the Mt. Floyd area to the south.

The second major orogeny to affect the Colorado Plateau since Precambrian time occurred in Late Miocene and Early Pliocene time. Throughout the

region west of the Rocky Mountains the earth's crust was under tensional stress and normal faulting became prevalent over the Colorado Plateau. This was the Basin and Range Orogeny and it was largely responsible for the intense block faulting in the Basin and Range Province to the west and south of the Colorado Plateau. Normal faulting commenced in Late Miocene time but appears to have reached its peak of intensity in Pliocene time in the Grand Canyon region. The great Hurricane Fault of western Grand Canyon, and the faulting along the West and Central Kaibab Fault zones, was initiated at this time, displacing the plateaus west of the Kaibab Plateau downward and leaving the Kaibab elevated above its surroundings.

Tensional stress downdropped central Arizona away from the Mogollon Rim and basaltic vulcanism closely followed the normal faulting. The renewed uplift of the Colorado Plateau left its surface at an average elevation of about one-and-one-half miles. The Pliocene Muddy Creek Formation was deposited in basins between the block-faulted mountains in the Lake Mead area. These deposits lie athwart the path of the present Colorado River near Hoover Dam. A date of 10.6 million years on the overlying Fortification Basalt member and lack of earlier Colorado River gravels indicate that the Colorado River could not have exited from the Grand Canyon area at that point before that date. Drainage west of the Kaibab Uplift apparently continued to be to the north and northwest as recently as 7.5-6 million years ago, as is indicated by arkosic gravels on the Shivwits Plateau capped by lavas of this age.

About 8.65 million years ago, a small olivene basalt flow poured out across what is now Red Butte, just south of the park. It caps approximately 1,000 feet of Triassic strata and indicates the thickness of Moenkopi and Chinle formations which still existed in this area at that time. A similar flow occurred at Cedar Ranch on the north side of the San Francisco Peaks and covered Traissic strata now lying 400 feet above the general surface of erosion. This flow has been dated at 5.49 million years, which is very close to the 5.8 million year date for the Switzer Mesa flow in nearby Flagstaff, Arizona.

The Cretaceous Mancos Formation outcrops only east of the Kaibab Plateau drainage divide. Microfossils from this formation are found in Colorado River sediments below Lake Mead that are no older than 5.5 million years. This indicates that the river depositing these sediments did not connect to drainages which breached the Kaibab Uplift until this time and that the western Grand Canyon was not in existence as we know it today. However, by 3.3 million years ago the Colorado River was well established in the western Grand Canyon and had cut to within 350 feet of its present elevation.

Lake Bidahochi formed in Late Miocene to Early Pliocene time in what is now the valley of the Little Colorado River, indicating that no great river such as the Colorado could have passed through there since that time. The westward flowing Little Colorado River, however, maintained a separate drainage to the south of Lake Bidahochi. The middle member of the Bidahochi Formation (the Hopi Buttes volcanics) has a radiometric age of 6.7 million years. Stage 1 volcanics of the San Francisco field

began eruption about 2.5 million years ago and eruptions have continued intermittently in that area until 1064 A.D. with the eruption of Sunset Crater. Lava flows have blocked the Colorado River near Toroweap in Grand Canyon National Monument. There is evidence to indicate that one of the lakes backed up behind the highest of these flows, probably extended upstream as far as Lees Ferry, and maintained itself until the lava dam was breached. The oldest of these canyon blocking flows has an age of 1.2 million years and shows that at that time the Colorado River had excavated the Grand Canyon to within 50 feet of its present depth.

The Pleistocene Epoch was marked by three periods of mountain glaciation in the San Francisco Peaks south of the park. Meltwaters from these glaciers and those upstream on the Colorado River drainage in the Rocky Mountains greatly increased the volume of water passing through the canyon and undoubtedly accelerated canyon cutting. The primary volcanoes in the San Francisco Peaks area were erupted furing the Pleistocene. The Tappan Wash flow, just east of the park, flowed into the Little Colorado in the last 500,000 years and blocked its flow for several miles. Very little erosion has occurred on the Coconino Plateau south of the park during the Pleistocene and appears today much as it did then.

began eruption about 2.5 million years ago and eruptions have continued intermittently in that area until 1064 A.D. with the eruption of Sunset Crater. Lava flows have blocked the Colorado River near Toroweap in Grand Canyon National Monument. There is evidence to indicate that one of the lakes backed up behind the highest of these flows, probably extended upstream as far as Lees Ferry, and maintained itself until the lava dam was breached. The oldest of these canyon blocking flows has an age of 1.2 million years and shows that at that time the Colorado River had excavated the Grand Canyon to within 50 feet of its present depth.

The Pleistocene Epoch was marked by three periods of mountain glaciation in the San Francisco Peaks south of the park. Meltwaters from these glaciers and those upstream on the Colorado River drainage in the Rocky Mountains greatly increased the volume of water passing through the canyon and undoubtedly accelerated canyon cutting. The primary volcanoes in the San Francisco Peaks area were erupted furing the Pleistocene. The Tappan Wash flow, just east of the park, flowed into the Little Colorado in the last 500,000 years and blocked its flow for several miles. Very little erosion has occurred on the Coconino Plateau south of the park during the Pleistocene and appears today much as it did then.

APPENDIX E

GRAND CANYON MAMMALS

SHREWS	
Merriam's Shrew	*Sorex merriami*
Dwarf Shrew	*Sorex nanus*
Desert or Gray Shrew	*Notiosorex crawfordi*
BATS	
California Myotis	*Myotis californicus*
Long-eared Myotis	*Myotis evotis*
Small-footed Myotis	*Myotis subulatus*
Long-legged Myotis	*Myotis volans*
Silver-haired Bat	*Lasionycteris noctivagans*
Western Pipistrelle	*Pipistrellus hesperus*
Big Brown Bat	*Eptesicus fuscus*
Red Bat	*Lasiurus borealis*
Hoary Bat	*Lasiurus cinereus*
Lump-nosed Bat	*Plecotus townsendii*
Pallid Bat	*Antrozous pallidus*
BEARS	
Black Bear	*Euarctus americanus*
RACCOON AND RINGTAIL	
Raccoon	*Procyon lotor*
Ringtail	*Bassariscus astutus*
COYOTES AND FOXES	
Coyote	*Canis latrans*
Gray Fox	*Urocyon cinereoargenteus*
CATS	
Mountain Lion	*Felis concolor*
Bobcat	*Lynx rufus*
SQUIRRELS, GROUND SQUIRRELS, CHIPMUNKS, PRAIRIE DOGS	
Whitetail or Gunnison's Prairie Dog	*Cynomys gunnisoni*
Golden-mantled Ground Squirrel	*Citellus lateralis*

White-tailed Antelope Squirrel	Citellus leucurus
Rock Squirrel	Citellus variegatus
Cliff Chipmunk	Eutamias dorsalis
Least Chipmunk	Eutamias minimus
Uinta Chipmunk	Eutamias umbrinus
Abert Squirrel	Sciurus aberti
Kaibab Squirrel	Sciurus kaibabensis
Red or Spruce Squirrel	Tamiasciurus hudsonicus

PORCUPINES

Porcupine	Erethizon dorsatum

WEASEL, BADGER, OTTER, SKUNKS

Long-tailed Weasel	Mustela frenata
River Otter	Lutra canadensis
Badger	Taxidea taxus
Spotted Skunk	Spilogale putorius
Striped Skunk	Mephitis mephitis

POCKET GOPHERS

Valley Pocket Gopher	Thomomys bottae
Northern Pocket Gopher	Thomomys talpoides

HAREA AND RABBITS

Blacktailed Jack Rabbit	Lepus californicus
Desert Cottontail	Sylvilagus audubonii
Mountain or Nuttall's Cottontail	Sylvilagus nuttallii

DEER, ANTELOPE, ELK, BIGHORN SHEEP, AND BURRO

Elk or Wapiti	Cervus canadensis
Mule Deer	Odocoileus hemionus
Prong-horned Antelope	Antilocapra americana
Desert Bighorn Sheep	Ovis canadensis
Burro	Equus asinus

BEAVER

Beaver	Castor canadensis

POCKET MICE AND KANGAROO RATS

Rock Pocket Mouse	Perognathus intermedius
Great Basin Pocket Mouse	Perognathus parvus
Merriam's Kangaroo Rat	Dipodomys merriami
Ord's Kangaroo Rat	Dipodomys ordii

MICE, RATS AND VOLES

Western Harvest Mouse	Reithrodontomys megalotis
Brush Mouse	Peromyscus boylii
Canyon Mouse	Peromyscus crinitus
Cactus Mouse	Peromyscus eremicus
Deer Mouse	Peromyscus maniculatus
Pinyon Mouse	Peromyscus truei
Northern Grasshopper Mouse	Onychomys leucogaster
White-throated Wood Rat	Neotoma albigula
Bushy-tailed Wood Rat	Neotoma cinerea
Desert Wood Rat	Neotoma lepida
Mexican Wood Rat	Neotoma mexicana
Stephen's Wood Rat	Neotoma stephensi
Longtailed Vole	Microtus longicaudus
Mexican Vole	Microtus mexicanus
House Mouse	Mus musculus

APPENDIX F

GRAND CANYON BIRDS

Compiled by Steven W. Carothers, Museum of Northern Arizona, Flagstaff,

R. Roy Johnson, National Park Service, Grand Canyon, Arizona, and

N. Joseph Sharber, Museum of Northern Arizona, Flagstaff.

Common names conform with the A.O.U. checklist of North American Birds, 5th edition, 1957 and 32nd supplement, Auk 90:411-419, 1973.

ABUNDANCE

C = common; easily found in proper habitat in the right season

F = fairly common; may be found in low numbers or scattered through the proper habitat in the right season

U = uncommon; may or may not be found with difficulty in proper habitat in the right season

R = rare; not to be expected, occurrence unpredictable

A = Accidental; completely out of normal range

[ ] = hypothetical; alleged occurrence in area, not substantiated

---

STATUS

p = permanent resident

s = summer resident

w = winter visitant

t = transient (migrant)

i = irregular

GENERAL HABITAT PREFERENCE*

L = Lower Sonoran; creosote bush desert, along Colorado River and tributaries below river mile 165

U = Upper Sonoran; ocotillo, sagebrush and blackbrush desert; pinyon-juniper and oak woodland, and above river mile 165

T = Transition; ponderosa pine forest, often mixed with Douglas fir and Gambel oak

C = Canadian; spruce and fir forest

*If no general habitat preference is listed, it may be expected to occur in all of the associations.

SPECIFIC HABITAT PREFERENCE

1 = marsh and open water

2 = riparian (streamside)

3 = grassland

4 = desertscrub

5 = pinyon-juniper and oak woodland

6 = coniferous forest

EXAMPLE: Cactus Wren R p L 4 (rare, permanent resident, Lower Sonoran, desertscrub)

GREBES	
Eared Grebe	U t LUT 1
Western Grebe	R t LU 1
Pie-billed Grebe	R t LUT 1
PELICANS	
Brown Pelican	A
CORMORANTS	
Double-crested Cormorant	R t LU 1
HERONS AND BITTERNS	
Great Blue Heron	F t LUT 1-2
Green Heron	R t LU 1-2
Common Egret	R t LU 1
Snowy Egret	U t LUT 1
Black-crowned Night Heron	U s L 1-2
[American Bittern]	
IBISES AND SPOONBILLS	
Wood Ibis	R t LUT 1-2
White-faced Ibis	U t LU 1
SWANS, GEESE AND DUCKS	
Canada Goose	U t 1
Snow Goose	R t LUT 1
Mallard	F t 1
[Gadwall]	R t 1
Pintail	U t 1
Green-winged Teal	U t 1
Blue-winged Teal	U t 1

Cinnamon Teal	U t 1
American Widgeon	R t 1
Shoveler	U t 1
Canvasback	R t 1
Redhead	R t 1
Ring-necked Duck	R t 1
Lesser Scaup	U t 1
[White-winged Scooter]	
Bufflehead	R t LU 1
Hooded Merganser	A
Common Merganser	R t 1
Red-breasted Merganser	R t 1
[Ruddy Duck]	
AMERICAN VULTURES	
Turkey Vulture	F s LUT 1-6
HAWKS AND HARRIERS	
Sharp-shinned Hawk	U t 2-6
Cooper's Hawk	U s 2,4,5-6
Goshawk	U s TC 6
Red-tailed Hawk	F p 2-6
Swainson's Hawk	U t 2-6
[Zone-tailed Hawk]	
Ferruginous Hawk	R t 3-6
Golden Eagle	U p UTC 2-6
Bald Eagle	R t U-T 1-6
Marsh Hawk	U t U-C 1-5

OSPREYS	
Osprey	R t 1-2
FALCONS	
Prairie Falcon	R p LUT 1-6
Peregrine Falcon	R p LUT 1-2,6
Pigeon Hawk	R t UT 2-6
Sparrow Hawk	F p 2-6
GROUSE AND QUAIL	
Blue Grouse	U p C 6
Gambel's Quail	U p LU 3-5
TURKEYS	
Turkey	F p 3,5-6
RAILS, GALLINULES AND COOTS	
Virginia Rail	R t 1
American Coot	U t 1
PLOVERS	
Killdeer	U t 1
SNIPE AND SANDPIPERS	
Wilson's Snipe	U t 1
Long-billed Curlew	R t 1
Spotted Sandpiper	U s and F t 1-2
Solitary Sandpiper	U t 1
Willet	R t 1
Greater Yellowlegs	R t 1
Least Sandpiper	U t LU 1
Long-billed Dowitcher	R t 1

AVOCETS AND STILTS	
American Avocet	U t LU 1
Black-necked Stilt	U t LU 1
PHALAROPES	
Wilson's Phalarope	R t LU 1
Northern Phalarope	R t LU 1
GULLS AND TERNS	
California Gull	R t 1
Ring-billed Gull	R t 1
Sabine's Gull	R i 1
Black Tern	R i 1
PIGEONS AND DOVES	
Band-tailed Pigeon	F s UT 5,6
Mourning Dove	F s L-C 2-6 and F w LU 2-5
Ground Dove	R i
CUCKOOS AND ROADRUNNERS	
Yellow Billed Cuckoo	R t LU 2
Roadrunner	U p LU 3-5
OWLS	
Screech Owl	U p UT 2,5-6
Flammulated Owl	R s TC 6
Great-horned Owl	F p 2-6
Mountain Pygmy Owl	R p TC 5-6
Burrowing Owl	R s U e
Spotted Owl	R p UT 5-6
Long-eared Owl	R i UT 2,5-6

Saw-whet Owl	U s TC 6
GOATSUCKERS	
Poorwill	F s LU 2-4
Common Night Hawk	F s UTC 5-6
SWIFTS	
Vaux's Swift	R t U 1-2
White-throated Swift	C p LUT 2-6
HUMMINGBIRDS	
Black-chinned Hummingbird	F s LU 2-5
Costa's Hummingbird	R s L 4
[Anna's Hummingbird]	
Broad-tailed Hummingbird	C s TC 6
Rufous Hummingbird	C t 2-6
Calliope Hummingbird	R t UT 5-6
KINGFISHERS AND WOODPECKERS	
Belted Kingfisher	U t LU 1-2
Flicker	C p T-C 6 and F w 2-6
[Pileated Woodpecker]	
Acorn Woodpecker	U s UT 5-6
Lewis' Woodpecker	R s UT 5-6 and U w UT 5-6
Yellow-billed Sapsucker	F s 2,5-6
Williamson's Sapsucker	U s C 6
Hairy Woodpecker	C p TC 6
Downy Woodpecker	R p TC 6
Ladder-backer Woodpecker	R s U 2,3,5
Northern Three-toed Woodpecker	R p C 6

TYRANT FLYCATCHERS	
Eastern Kingbird	R i
Western Kingbird	U s LU 2,5
Cassin's Kingbird	U s LU 2,5
Ash-throated Flycatcher	F s LU 2,5
Black Phoebe	F s LUT 2
Say's Phoebe	F p LU 2-5
Willow Flycatcher	U s U 2
Hammond's Flycatcher	R (?)
Dusky Flycatcher	R (?)
Gray Flycatcher	R (?)
Western Flycatcher	U t 2,4-6
Western Wood Pewee	F s UTC 2,5-6
Olive-sided Flycatcher	U s TC 6
Vermillion Flycatcher	R t L 2
LARKS AND SWALLOWS	
Horned Lark	C p U 3
Violet-green Swallow	C s TC 6 and LU (cliffs)
Tree Swallow	R i LU 1-2
Bank Swallow	R i LU 1-2
Rough-winged Swallow	U t LU 1-2
Barn Swallow	R i LU 1-2
Cliff Swallow	R s U (cliffs)
Purple Martin	U t TC 6
CROWS AND JAYS	
Steller's Jay	C p T 6

Scrub Jay	F p U 5
Common Raven	C p UTC 2-6
Common Crow	U t TC 3,5-6
Pinyon Jay	F p UT 5-6
Clark's Nutcracker	U p TC 6
CHICKADEES, TITMICE AND BUSHTITS	
Mountain Chickadee	C p UT 5-6
[Bridled Titmouse]	
Plain Titmouse	F p U 5
Verdin	R s L 2,4
Common Bushtit	F p U 5
NUTHATCHES AND CREEPERS	
White-breasted Nuthatch	F p UT 2,5-6
Red-breasted Nuthatch	U p TC 6
Pygmy Nuthatch	C p T 6
Brown Creeper	F s C 6 and F w T 6
DIPPERS	
Dipper	F p (permanent side streams)
WRENS	
House Wren	F s TC 6
Winter Wren	R t LUT 2-6
Bewick's Wren	U s U 2-5
Cactus Wren	R p L 4
Long-billed Marsh Wren	R t 1
Canyon Wren	C p (cliffs)
Rock Wren	C p U 3-5

MOCKINGBIRDS AND THRASHERS	
Mockingbird	U s U 3-4
Sage Trasher	U t U 3-4
ROBINS AND THRUSHES	
Robin	C s TC 6 and U w LUT 2-6
Hermit Thrush	C s TC 6
Western Bluebird	C s TC 6 and C w LUT 2-6
Mountain Bluebird	F s TC 3 and U w U 3-5
Townsend's Solitaire	F t UTC 5-6
OLD WORLD WARBLERS, GNATCATCHERS AND KINGLETS	
Blue-gray Gnatcatcher	F s U 2,4
Black-tailed Gnatcatcher	R p L 2
Golden-crowned Kinglet	U s C 6
Ruby-crowned Kinglit	C s C 6 and F w LU 2
PIPITS	
Water Pipit	R i 1-2
WAXWINGS AND SILKY FLYCATCHERS	
Cedar Waxwing	U t UT 2,6
Bohemian Waxwing	R i
Phainopepla	R s LU 2,4
SHRIKES	
Loggerhead Shrike	U s and R w LU 3,5
STARLINGS	
Starling	U s (suburban areas)
VIREOS	
Bell's Vireo	U s LU 2

Gray Vireo	R s U 5
Solitary Vireo	C s T 6
Red-eyed Vireo	A
Warbling Vireo	U s TC 2,6
WOOD WARBLERS	
Orange-crowned Warbler	U t UT 2,5-6
Nashville Warbler	U t UT 2,6
Virginia's Warbler	F s TC 6
Lucy's Warbler	C s LU 2,4
Yellow Warbler	F s LU 2
Yellow-rumped Warbler	C s C 6 and C t LU 2
Black-throated Gray Warbler	F s U f
Townsend's Warbler	U t UTC 2,5-6
Black-throated Green Warbler	A
Hermit Warbler	U t TC 6
Grace's Warbler	F s T 6
Ovenbird	A
Northern Waterthrush	R t LU 2
MacGillivray's Warbler	U t TC 2,3,6
Yellowthroat	U s LU 1-2
Yellow-breasted Chat	U s LU 1-2
Wilson's Warbler	F t LUT 2,6
American Redstart	R i LU 2
Painted Redstart	R i LU 2
WEAVER FINCHES	
House Sparrow	F p (suburban areas)

MEADOWLARKS AND BLACKBIRDS

Eastern Meadowlark	R i
Western Meadowlark	F p U 3-4
Yellow-headed Blackbird	U t 1-2
Red-winged Blackbird	F p LU 1-2
Hooded Oriole	U s LU 2
Scott's Oriole	U s U 5
Northern Oriole	U s LU 2
Rusty Blackbird	A
Brewer's Blackbird	F s TC 2-6
Great-tailed Grackle	R i LU 1-2
Brown-headed Cowbird	F s 1-6
Bronzed Cowbird	R i

TANAGERS

Western Tanager	C t LU 2 and F s TC 6
Hepatic Tanager	R t UT 2,5
Summer Tanager	R s L 2

GROSBEAKS, FINCHES, SPARROWS AND BUNTINGS

Rose-breasted Grosbeak	R i
Black-headed Grosbeak	C s UT 5,6
Blue Grosbeak	F s LU 2
Indigo Bunting	U s LU 2
Lazuli Bunting	U s LU 2
Dickcissel	R t LU 2
Evening Grosbeak	F i TC 6
Black Rosy Finch	R i

Purple Finch	R i
Cassin's Finch	F p TC 6
House Finch	F s LUT 2-6
Pine Grosbeak	R i UTC 5-6
Pine Siskin	F p TC 6
American Goldfinch	R i 3,6
Lesser Goldfinch	F s U 2
Red Crossbill	F i TC 6
Green-tailed Towhee	F s C 3,6 and w LU 2
Rufous-sided Towhee	F s UT 5-6
Brown Towhee	R i
Lark Bunting	R i
Savannah Sparrow	F t LU 2
Grasshopper Sparrow	A
Vesper Sparrow	U s U 3
Lark Sparrow	U s U 3,4
Rufous-crowned Sparrow	U p U 4-5
Black-throated Sparrow	F s U 3-4
Sage Sparrow	U t U 3-5
Slate-colored Junco	R w UTC 2,5-6
Oregon Junco	C w UTC 2,5-6
Gray-headed Junco	C s TC 5-6 and w 2,5-6
[Tree Sparrow]	
Chipping Sparrow	C s TC 6
Brewer's Sparrow	U w LU 3-4
Black-chinned Sparrow	U s U 4-5

White-crowned Sparrow	C w 2-5 and [R s C 6]
White-throated Sparrow	A
Fox Sparrow	R t
Lincoln's Sparrow	U t 1-2
Swamp Sparrow	A
Song Sparrow	U s LU 1-2
Harris Sparrow	A
Golden Crowned Sparrow	A

APPENDIX G

LIST OF AMPHIBIANS AND REPTILES FOUND IN GRAND CANYON NATIONAL PARK

SALAMANDERS	
Tiger Salamander	*Ambystoma tigrinum*
FROGS AND TOADS	
Great Basin Spadefoot	*Scaphiopus intermontanus*
Red-spotted Toad	*Bufo punctatus*
Woodhouse's Toad	*Bufo woodhousei*
Canyon Treefrog	*Hyla arenicolor*
Leopard Frog	*Rana pipiens*
LIZARDS	
Banded Gecko	*Coleonyx variegatus*
Chuckwalla	*Sauromalus obesus*
Zebra-tailed Lizard	*Callisarus draconoides*
Desert Collared Lizard	*Crotaphytus insularis*
Collared Lizard	*Crotaphytus collaris*
Desert Horned Lizard	*Phrynosoma platyrhinos*
Short-horned Lizard	*Phrynosoma douglassi*
Tree Lizard	*Uta ornata*
Side-blotched Lizard	*Uta stansburiana*
Sagebrush Lizard	*Sceloporus graciosus*
Fence Lizard	*Sceloporus undulatus*
Desert Spiny Lizard	*Sceloporus magister*
Western Whiptail	*Cnemidophorus tigris*
Plateau Whiptail	*Cnemidophorus velox*
Many-lined Skink	*Eumeces multivirgatus*
Western Skink	*Eumeces skiltonianus*
Gila Monster	*Heloderma suspectum*
SNAKES	
Western Blind Snake	*Leptotyphlops humilis*
Striped Whipsnake	*Masticophis taeniatus*
Red Racer	*Masticophis flagellum*
Western Patch-nosed Snake	*Salvadora hexalepsis*
Gopher Snake	*Pituophis melanoleucus*
Long-nosed Snake	*Rhinocheilus lecontei*
Common Kingsnake	*Lampropeltis getulus*
Sonora Mountain Kingsnake	*Lampropeltis pyromelana*
Western Ground Snake	*Sonora semiannulata*
Sonora Lyre Snake	*Trimorphodon lambda*
Spotted Night Snake	*Hypsiglena ochrorhyncha*
Black-headed Snake	*Tantilla planiceps*

Western Garter Snake	*Thamnophis elegans*
Black-tailed Rattlesnake	*Crotalus molossus*
Western Rattlesnake	*Crotalus viridis*
Speckled Rattlesnake	*Crotalus mitchelli*

TORTOISES

Desert Tortoise	*Gopherus agassizi*

APPENDIX H

No accurate vegetational maps have been prepared for Grand Canyon National Park. The following vegetational data is only for Grand Canyon National Park prior to PL 93-620.

VEGETATION	AREAL EXTENT IN ACRES	
	Sub-Types	Types
Sagebrush: Areas on which sage (Artemisia sp.) is dominant to the exclusion of tree species.		
Artemisia tridentata, Atriplex canescens, Cowinia stansburiana, Amelanchier utahensis, Ephedra viridis.	37,810	
Semi-barren	6,879	
		44,690
Sonoran Chaparral: Areas on which 80 percent of the vegetative cover consists of chaparral species characteristic of the Sonoran Life Zone and which are not capable of producing commercial stands of timber.		
Browsing species: Amelanchier utahensis, Quercus utahensis, Atriplex canescens, Cowinia stansburiana, Artemisia tridentata, Ptelea baldwinii crenulata, Leparagyrea rotundifolia, Ephedra viridis, Quercus turbinella, Arctostaphylos pungens, Garrya flavescens, Cercocarpus ledifolius.	15,505	
Semi-barren	11,397	
Non-browsing species: Grossularia inermis, Glossopetalon spinescens, Cercocarpus intricatus, Yucca sp., Robinia neomexicana luxurians, Gutierrezia sarothrae, Fallugia paradoxa, Rhus trilobata, Coleogyne ramosissima, Opuntia sp., Acacia greggii, Quercus undulata, Salidago sp.	35,076	
Semi-barren	13,583	
		75,561
Timberland Chaparral: Areas on which 80 percent of the vegetative cover consists of chaparral species characteristic of the Transition Life Zone or on which commercial stands of timber could be grown.		

Browsing species:
Quercus utahensis, Amelanchier utahensis, Artemisia tridentata, Ephedra viridis, Quercus turbinella, Lepargyrea rotundifolia, Symphoricarpus albus, Acer glabum, Cowania stansburiana, Symphoricarpus oreophilus, Arctostaphylos pungens. 13,006
Semi-barren 738

Non-browsing species:
Quercus undulata, Garrya flavescens, Acer grandidentatum, Robinia neomexicana luxurians, Holodiscus glabrescens, Rhus trilobata, Phelea baldwinii crenulata, Cerococarpus intricatus. 12,499
Semi-barren 217
26,460

Semi-Desert Chaparral: Similar in species composition to the chaparral type but differing from it by being characteristically open. This type usually occupies slopes either bordering the desert, or within the range of desert climatic influence.

Browsing species:
Ephedra viridis - Grass 3,375

Non-browsing species:
Coleogyne ramosissima, Opuntia sp., Yucca baccata, Yucca sp., Fallugia paradoxa, Rhus trilobata, Quercus turbinella, Acacia greggii, Gutierrezia Sarothrae. 91,126
Semi-barren 31,121
125,622

Woodland - Chaparral: Areas on which 80 percent or more of both broadleaf trees and chaparral species are present, each being present to at least 20 percent of the entire type. 452

Woodland: Areas consisting of 80 percent or more of broadleaf tree species. 4,219

Pinyon - Juniper: Areas on which 20 percent or more of Pinyon pines of Juniperus spp. are present, to the exclusion of commercial tree species.

Browsing species:		
Pinus edulis, Juniperus californica utahensis, Artemisia tridentata, Cowania stansburiana, Arctostaphylos pungens, Quercus turbinella, Lepargyrea rotundifolia, Quercus utahensis, Amelanchier utahensis, Garrya flavescens, Atriplex canescens, Acer grandidentatum, Cercocarpus montanus, Ephedra viridis, Ptelea baldwinii crenulata, Grass.	64,648	
Semi-barren	4,924	
Non-browsing species:		
Pinus edulis, Juniperus californica utahensis, Quercus turbinella, Caleogyne ramosissima, Fallugia paradoxa, Acacia greggii, Rhus trilobata, Quercus undulata, Cercocarpus ledifolius, Cercocarpus intricatus, Ceanothus greggii, Glossopetalon spinescens, Ribes cerum.	80,859	
Semi-barren	3,914	
		154,345
Douglas Fir: Areas on which there is a dominance of Douglas Fir to the exclusion of commercial pines.		
Pseudotsuga taxifolia		401
Fir-Douglas Fir: Areas on which Abies sp., and Pseudotsuga taxifolia each occupy at least 20 percent of the stand of coniferous trees to the exclusion of Pinus ponderosa.	1,305	
Abies concolor, Pseudotsuga taxifolia		
Abies concolor, Pseudotsuga taxifolia, Pinus edulis, Juniperus californica utahensis	37	
Pseudotsuga taxifolia, Pinus edulis, Juniperus californica utahensis	37	
Abies concolor, Pseudotsuga taxofolia, Abies lasiocarpa, Picea pungens, Populus tremuloides	23	
Abies lasiocarpa, Pseudotsuga taxifolia, Picea pungens, Populus tremuloides	41	
Abies concolor, Pseudotsuga taxifolia, Populus tremuloides	198	
Abies concolor, Pseudotsuga taxifolia, Holodiscus glabrescens	18	

Abies concolor, Pseudotsuga taxifolia, Quercus utahensis	37	
Abies concolor, Pseudotsuga taxifolia, Amelanchier utahensis	14	
Abies concolor, Pseudotsuga taxifolia, Robinia neomexicana luxurians, Quercus utahensis, Acer grandidentatum	23	
Abies concolor, Pseudotsuga taxifolia, Pinus edulis, Juniperus californica utahensis, Amelanchier utahensis, Arctostaphylos pungens	18	
Abies concolor, Pseudotsuga taxifolia, Picea pungens	5	
Abies lasiocarpa, Pseudotsuga taxofolia, Picea pungens	5	
		1,761

5 Ponderosa Pine: Areas on which Pinus ponderosa occurs to the extent of 20 percent or more, to the exclusion of true firs and Douglas firs.

Pinus ponderosa	19,272
Pinus ponderosa, Populus tremuloides	10,244
Pinus ponderosa, Quercus utahensis (Shrub form)	11,111
Pinus ponderosa, Pseudotsuga taxifolia, Populus tremuloides	92
Pinus ponderosa, Picea pungens, Populus tremuloides	1,540
Pinus ponderosa, Picea pungens	41
Pinus ponderosa, Pseudotsuga taxifolia, Picea Pungens, Populus tremuloides	111
Pinus ponderosa, Populus tremuloides, Grass	267
Pinus ponderosa, Pseutotsuga taxifolia, Quercus utahensis	65
Pinus ponderosa, Quercus utahensis, Robinia neomexicana luxurians	669

Pinus ponderosa, Quercus utahensis, Amelanchier utahensis	14
Pinus ponderosa, Arctostaphylos pungens	369
Pinus ponderosa, Grass	281
Pinus ponderosa, Picea pungens, Populus tremuloides, Grass	32
Pinus ponderosa, Pteris aquillinn, Grass	5
Pinus ponderosa, Picea engelmanii, Pseudotsuga taxifolia, Picea pungens	23
Pinus ponderosa, Picea engelmanii, Populus tremuloides	23
Pinus ponderosa, Picea engelmanii, Picea pungens, Populus tremuloides	120
Pinus ponderosa, Quercus utahensis, Robinia neomexicana luxurians, Amelanchier utahensis	18
Pinus ponderosa, Populus tremuloides, Quercus utahensis, Robinia neomexicana luxurians	14
Pinus ponderosa, Robinia neomexicana luxurians	198
Pinus ponderosa, Populus tremuloides, Robinia neomexicana luxurians	55
Pinus ponderosa, Populus tremuloides, Quercus utahensis	23
Pinus ponderosa, Pinus edulis, Juniperus californica utahensis	7,372
Pinus ponderosa, Cowania stansburiana	28
Pinus ponderosa, Cowania stansburiana, Grass	41
Pinus ponderosa, Quercus utahensis, Cowania stansburiana, Grass	23
Pinus ponderosa, Quercus utahensis, Cercocarpus ledifolius	46
Pinus ponderosa, Quercus utahensis, Cowania stansburiana	1,568

Pinus ponderosa, Quercus utahensis, Grass	65	
Pinus ponderosa, Artemisia tridentata, Cowania stansburiana	28	
Pinus ponderosa, Pinus edulis, Juniperus californica utahensis, Cowania stansburiana	286	
Pinus ponderosa, Quercus utahensis, Artemisia tridentata	1,706	
Pinus ponderosa, Artemisia tridentata	1,489	
Pinus ponderosa, Pinus edulis, Juniperus californica utahensis, Quercus utahensis, Artemisia tridentata	309	
Pinus ponderosa, Quercus utahensis, Artemisia tridentata, Cowania stansburiana	18	
Pinus ponderosa, Pinus edulis, Juniperus californica utahensis, Quercus utahensis	217	
Pinus ponderosa, Quercus utahensis (Tree form)	69	
		57,880

Pine-Fir-Douglas Fir: Areas on which Pinus ponderosa, Douglas fir, and Abies sp., each occur to the extent of 20 percent or more of the stand of coniferous tree species.

Pinus ponderosa, Pseudotsuga taxifolia, Abies concolor	4,214	
Pinus ponderosa, Pseudotsuga taxifolia, Abies concolor, Quercus utahensis	438	
Pinus ponderosa, Pseudotsuga taxifolia, Abies concolor, Pinus edulis, Juniperus californica utahensis	55	
Pinus ponderosa, Abies concolor, Populus tremuloides	7,815	
Pinus ponderosa, Pseudotsuga taxifolia, Abies concolor, Populus tremuloides	8,497	
Pinus ponderosa, Abies concolor	397	
Pinus ponderosa, Abies lasiocarpa, Picea pungens, Populus tremuloides	212	

Pinus ponderosa, Abies lasiocarpa, Populus tremuloides	9	
Pinus ponderosa, Picea pungens, Abies lasiocarpa	18	
Pinus ponderosa, Picea pungens, Abies concolor, Abies lasiocarpa, Populus tremuloides	65	
Pinus ponderosa, Pseudotsuga taxifolia, Abies concolor, Picea pungens, Populus tremuloides	120	
Pinus ponderosa, Picea engelmanii, Picea pungens, Pseudotsuga taxifolia, Abies concolor	101	
Pinus ponderosa, Picea pungens, Abies concolor, Pseudotsuga taxifolia	55	
Pinus ponderosa, Picea engelmanii, Pseudotsuga taxifolia, Abies concolor	217	
Pinus ponderosa, Picea engelmanii, Picea pungens, Abies concolor, Populus tremuloides	23	
Pinus ponderosa, Abies concolor, Pseudotsuga taxifolia, Amelanchier utahensis	37	
Pinus ponderosa, Picea pungens, Abies concolor, Populus tremuloides	166	
Pinus ponderosa, Abies concolor, Pseudotsuga taxifolia, Quercus utahensis, Amelanchier utahensis	175	
Pinus ponderosa, Abies concolor, Populus tremuloides, Robinia neomexicana luxurians	9	
Pinus ponderosa, Abies concolor, Pseudotsuga taxifolia, Quercus utahensis, Robinia neomexicana luxurians	55	
Pinus ponderosa, Abies concolor, Pseudotsuga taxifolia, Arctostaphylos pungens	28	
		22,707

Fir: Areas on which there is a dominance of Abies sp., to the exclusion of commercial pines.

Abies concolor, Abies lasiocarpa, Populus tremuloides	28	

, Picea pungens	18
, Picea pungens, Populus	23
icolor, Populus tremuloides	120
lasiocarpa, Picea pungens, Abies concolor, lus tremuloides	78
bies lasiocarpa, Picea pungens, Populus remuloides	14
Abies concolor, Quercus utahensis, Robinia neomexicana luxurians	23
Abies concolor	5

309

Spruce: Areas on which spruce is the dominant tree species, to the exclusion of Ponderosa pine.

Picea pungens, Populus tremuloides	881
Picea pungens, Populus tremuloides, Grass	148
Picea pungens	9
Picea pungens, Abies lasiocarpa, Populus tremuloides	443
Picea pungens, Abies lasiocarpa, Pseudotsuga taxifolia, Populus tremuloides	60
Picea pungens, Picea engelmanii, Abies lasiocarpa, Populus tremuloides	286
Picea pungens, Picea engelmanii, Abies lasiocarpa	46
Picea pungens, Picea engelmanii, Abies concolor, Populus tremuloides	9
Picea engelmanii, Picea pungens, Populus tremuloides	37
Picea engelmanii, Abies lasiocarpa, Populus tremuloides	74
Picea pungens, Abies lasiocarpa	9

Picea pungens, Abies concolor, Pseudotsuga taxifolia	9	2,010
Grassland: Areas on which 80 percent or more of the vegetation is herbaceous.		47,500
Barren: Areas which have less than 20 percent cover in vegetation.		10,000
Unclassified: Developed and residential areas, roads, stream channels, other works of man, etc., not classifiable, or not surveyed (considerable acreage below the rim of the canyon remains unsurveyed).		97,835
TOTAL		673,575

APPENDIX I

A BRIEF HISTORY OF THE VEGETATION OF THE GRAND CANYON REGION

In a broad sense, the vegetation of the Grand Canyon region has arisen as a result of climatic changes involving temperature, moisture, and elevation. Early in the Cenozoic (approximately 75,000,000 years ago) the North American continent was covered by three great geofloras. A geoglora is a major vegetational unit that has maintained its identity over a long period of time. These geofloras were the Arcto-Tertiary Geoflora, dominated by conifers and broad leafed hardwoods, the Madro-Tertiary Geoflora, so named from its place of origin in the Sierra Madre Mountains of Mexico, dominated by microphyllous sclerophyllous species, and the Neotropical-Tertiary Geoflora, dominated by megophyllous tropical vegetation. The Neotropical-Tertiary Geoflora was confined to the southern half of the continent, the Arcto-Tertiary Geoflora was on what is now the United States and Canada, and the Madro-Tertiary Geoflora was in northern Mexico. At that time, rainfall throughout much of the western United States was probably 80 inches a year or more and the temperature was much warmer than now.

Vegetational changes of great importance started during the Eocene in response to a cooling and drying climate. At this time, these geofloras formed a vast forest mosaic which was not of uniform composition. Cooling and drying soon eliminated the Neotropical-Tertiary Geoflora from the west. It played no further part in the evolution of our present flora aside from some contribution to the Madro-Tertiary Geoflora. Meanwhile, the Arcto-Tertiary and particularly the Madro-Tertiary Geofloras expanded considerably. This trend was accelerated in the Grand Canyon region by the upthrust of the Sierra Nevada, the California Coast Range, and the Transverse Ranges, all of which tended to cause a pronounced rain shadow in western Arizona. The upwarp of the Coconino-Kaibab Plateaus and the vulcanism that formed the San Francisco Peaks complex and the Mount Emma, Slide Mountain, and Mount Trumbull Range, caused increased cooling. These cool mountains became floral refuges.

Through the Oligocene, Miocene, and Pliocene the cooling and drying were accompanied by a shift from a summer wet period toward a summer dry precipitation pattern. This latter change was quite important to the subsequent evolution of the Madro-Tertiary and the differentiation of both geofloras into a number of elements.

These elements were:

Madro-Tertiary Geoflora

1. Sierra Madrean Woodland Element - Survives in northern Mexico, Arizona, New Mexico, and western Texas. Many of the typical genera were derived

from the old association of the Madro-Tertiary and the Neotropical-Tertiary Geofloras. The resultant flora is richer in rose and leguminous species than would otherwise be expected. Typical genera are Robinia, Populus, Arbutus, Cupressus, Prosopis, and Agave.

2. Conifer Woodland Element - Survives in eastern California, western Arizona, and Nevada. These areas are less deficient in summer precipitation. Taxa typical of this element are Pinus edulis, P. monophylla, P.cembroides, Juniperus, Amalanchier, and Cercocarpus.

3. California Woodland Element - Not represented in the park to an important extent. Genera typical of this element include live oaks and Platanus.

Arcto-Tertiary Geoflora - requiring less summer precipitation:

1. Western American Element

A. Cold-Wet Element - typified in our area by Picea, Abies, Pseudotsuga and Acer.

B. Cold-Dry Element - typified in our area by the Diploxylon pines (most importantly Pinus ponderosa), Poa, Quercus, and others.

2. Eastern American Element - abundant summer precipitation, typical of the eastern hardwood forests.

At the beginning of the Pliocene, these elements were mixed in a woodland of general but not uniform composition. Continued cooling through climatic and elevational influences and the shift toward winter dominant precipitation reduced the importance of the Madro-Tertiary elements in the far west but it flourished east of the Sierra Nevada. In northern Arizona, the Conifer Woodland Element of the Madro-Tertiary Geoflora and the Cold-Dry Element of the Arcto-Tertiary were well established.

With the onset of the cold of the Pleistocene, the vegetation of the western United States was displaced southward, apparently little else changed. At the end of the Pleistocene with the return of a warm/dry climate, the most recent evolutionary process was completed with the appearance of the modern xeric species of the western deserts. In the southwest, the more mesic elements of the Arcto-Tertiary Geoflora followed the warming and drying climate northward, ascending mountain slopes and highlands were representative communities of plants eventually became isolated, surrounded by warmer deserts. These relicts survive on the Coconino-Kaibab Plateaus, the San Francisco Peaks, and the mountains of Grand Canyon National Park in the Tuweep-Toroweap areas, essentially unmodified since the late Pleistocene. The more xerophyllous Conifer Woodland Element of the Madro-Tertiary Geoflora followed a similar pattern but generally lies below the Cold-Dry Element of the Arcto-Tertiary. These forests have retained much of their

ancient aspects because they are mostly populated by species of the family Pinaceae, well known for its genetic stability, and have not evolved to a major extent during the Cenozoic.

Broad leafed species of the Arcto-Tertiary Geoflora and the Sierra Madrean Woodland Element of the Madro-Tertiary underwent major evolutionary changes at the end of the Pleistocene as they adapted to the climatic conditions then forming on the four American deserts as well as in the Mediterranean climate zone on the Coast of California. The plants of the Great Basin (cold) desert (Artemisia tridentata, Sarcobatus, Atriplex, Chrysothamnus, etc.) evolved from the Arcto-Tertiary Geoflora, while the vegetation of the hot deserts (Mojave, Chihuahuan, and Sonoran) evolved from the Madro-Tertiary Geoflora. Many of these species are familiar in Grand Canyon and at the lower elevations of the Tuweep-Toroweap area. Larrea tridentata (Mojave), Agave, Yucca (Chihuahuan) and Ferrocactus acanthodes, Opuntia, and Franseria (Sonoran) are a few common representatives.

The Grand Canyon is renowned as a geological cross section of the earth's history, but it is also a remarkable exhibit of the vegetational history of the west during the Cenozoic and recent times. It is unusual to find elements of the four American deserts and the Coniferous elements of the Madro-Tertiary and Arcto-Tertiary Geofloras within a half day's travel. As a scientific resource, the area is important but so far neglected. For example, recent hybridization between two species of oak in the Slide Mountain area may closely parallel that which took place on the east side of the Cascade Mountains and may represent continued floral evolution today within the Madro-Tertiary Geoflora. Also, because of the relictual and isolated nature of the mountain floras in the park, a considerable amount of endemism is to be expected. This latter hypothesis has not as yet been thoroughly investigated.

The great diversity of vegetation types found within the park is seen in the following listing of plant types and examples within the park. The nomenclature is that currently being used by park research scientists in preparing vegetational maps of the park. The symbols given to the right of each vegetation type are for map designations and the numerical code for each type is for computer use.

VEGETATION TYPES

PRESENT AT GRAND CANYON NATIONAL PARK, ARIZONA

1 CLOSED VEGETATION (Crown or peripheries of plants touching or overlapping)

A FOREST (Closed woody vegetation, 5 m or more tall)

1 EVERGREEN FOREST (At least the canopy layer with no significant leafless period)

1A17A1 CLOSED RESINOUS EVERGREEN NARROW SCLEROPHYLL CONICAL CROWN FOREST. . . . . 

ex. Closed forest dominated by trees with needle-like leaves. The trees are resinous in nature and have conical crowns with flexible branches. The crown shape is important for shedding heavy snow loads. The spruce-fir forest of the North Rim is a good example of this forest type.

1A17A2 CLOSED RESINOUS EVERGREEN NARROW SCLEROPHYLL OVAL CROWN FOREST. . . . . 

ex. Closed forest dominated by trees with needle-like leaves. The trees are resinous in nature and have oval, not spire-shapped, crowns. This crown shape is less efficient for shedding snow and this vegetation type is not found in areas with a winter snow packe greater than 1.5 m. The ponderosa forests of the park are our only examples of this vegetation type.

1A17A3 CLOSED RESIONOUS EVERGREEN NARROW SCLEROPHYLL WIDE CROWN FOREST. . . . . 

ex. Closed forest dominated by trees with needle-like leaves. The trees are resinous in nature (the type may have a considerable admixture of non-resinous species such as juniper) with the bole of the tree much branched, giving a tree with a wide-spreading crown. This crown shape sheds snow poorly and snowfalls greater that 0.3 m often cause these trees to break down. The pinyon-juniper forest is our only example of this type.

2 DECIDUOUS FOREST (At least the canopy layer bare of leaves for a period during the cold or dry season)

1A21X1 CLOSED WINTER DECIDUOUS ORTHOPHYLL NARROW CROWN FOREST. . . . . †

ex. Closed forest dominated by trees with soft, normal sized leaves. Tree crowns are narrow oval in outline with the boles little branched. These trees are found in areas with heavy winter snow loads which are easily shed. Dense stands of aspen are our best example of this type.

1A21X2 CLOSED WINTER DECIDUOUS ORTHOPHYLL WIDE CROWN FOREST. . . . . T

ex. Closed forest dominated by trees with soft normal size leaves. Tree crowns are wide spreading and unsuited to bearing heavy snow loads. This type may not exist at Grand Canyon but if they do, cottonwoods in very dense stands would be an example.

1A25XØ CLOSED DECIDUOUS THORN FOREST. . . . . ⊢

ex. Closed forest dominated by trees armed with thorns. The leaves are mostly quite small and may be summer deciduous in the hottest season. Dense stands of mesquite on favorable sites.

B SCRUB (Closed woody vegetation, 5 m or less tall)

1 EVERGREEN SCRUB (At least the shrub layer with no significant leafless period)

1B11AØ CLOSED BROAD LEAF EVERGREEN ORTHOPHYLL SCRUB. . . . . ⊶

ex. Closed scrub with normall size soft leaves. typical of the mesic phases of the chaparral growing below the canyon rims.

1B14AØ CLOSED MESOPHYLLOUS EVERGREEN BROAD SCLEROPHYLL SCRUB. . . . . ⊷

ex. Closed scrub with normal size but hardened leaves. Usually growing on more xeric sites than 1B11AØ. Closed stands of buffaloberry, manzanita, or Quercus turbenella.

1B17XØ CLOSED STRAIGHT EVERGREEN NARROW SCLEROPHYLL SCRUB. X

ex. Closed stands of conifer reproduction. No distinction is made between resinous and non-resinous forms or between crown shapes since these characteristics do not play an important role in distribution of these types.

1B18CØ GRAY MICROPHYLOUS EVERGREEN SCRUB. . . . . Γ

ex. Scrub in closed stands with gray or gray-green colored leaves. Artemisia tridentata growing on the best sites.

2 DECIDUOUS SCRUB (Shrubs periodically bare of leaves, usually in the dry season or in winter)

1B21XØ CLOSED MESOPHYLLOUS DECIDUOUS ORTHOPHYLL SCRUB. . . . . 

ex. Closed stands of scrub with normal size soft leaves. Dense stands of willow or Quercus gambelii.

1B24XØ CLOSED DECIDUOUS THORN SCRUB. . . . . H

ex. Closed scrub dominated by species with small leaves and armed with thorns. This type may not exist at Grand Canyon but would be represented by low stands of mesquite.

C CLOSED DWARF SCRUB (Closed predominantly woody vegetation less than 0.5 m tall)

1 DWARF SCRUB EVERGREEN (At least the dwarf scrub layer with no significant leafless period)

1C12AØ MESOPHYLLOUS BROAD SCLEROPHYLL DWARF SCRUB. . . 

ex. Low woody closed vegetation with normal size hardened leaves. Usually found of xeric sites. Manzanita and Quercus turbenella on exposed sites.

D OPEN FOREST WITH CLOSED LOWER LAYERS (Trees with crowns not touching, crowns mostly not separated by more than their diameters)

1 EVERGREEN OPEN FOREST WITH CLOSED LOWER LAYERS (The tree layer at least without a significant leafless period)

1D14A1 RESINOUS OPEN EVERGREEN NARROW SCLEROPHYLL CONICAL CROWN FOREST WITH CLOSED LOWER LAYERS. . . . . 
ex. Spruce-fir forests with closed herbaceous layers. Usually encountered when tree invasion of meadows is taking place.

1D14A2 RESINOUS OPEN EVERGREEN NARROW SCLEROPHYLL OVAL CROWN FOREST WITH CLOSED LOWER LAYERS. . . . . 
ex. Open forest dominated by trees with oval crowns with the forest floor supporting a closed stand of grasses and herbs. Ponderosa forest with a closed layer of Poa fendleri.

1D14A3 RESINOUS OPEN EVERGREEN NARROW SCLEROPHYLL WIDE CROWN FOREST WITH CLOSED LOWER LAYERS. . . . . 
ex. Forest with wide spreading crowns on exposed sites but at higher elevations with adequate precipitation. Pinyon-juniper growing on exposed slopes with sagebrush and grasses.

1D14BØ NON-RESINOUS OPEN EVERGREEN NARROW SCLEROPHYLL FOREST WITH CLOSED LOWER LAYERS . . 
ex. Forest dominated by trees of a non-resinous nature, usually with wide spreading crowns. Almost pure stands of juniper with a closed herbaceous layer.

2 DECIDUOUS OPEN FOREST WITH CLOSED LOWER LAYERS (Trees with crowns not touching, crowns mostly not separated by more than their diameters. The tree layer deciduous, periodically bare of leaves at least during the dry season or in the winter.)

1D21X1 OPEN DECIDUOUS ORTHOPHYLL NARROW CROWN FOREST WITH CLOSED LOWER LAYERS. . . . . 
ex. Deciduous forest with normal size soft leaves, their boles essentially unbranched. The lower layers (usually herbaceous) closed. Aspens growing above brush, herbs and grasses on sites following severe fires.

1D21X2 OPEN DECIDUOUS ORTHOPHYLL WIDE CROWN FOREST WITH CLOSED LOWER LAYERS. . . . . 
ex. Deciduous forest with normal size soft leaves, their boles usually branched giving rise to a wide spreading crown. The lower layers closed and in riparian habitats, consisting of grasses. Cottonwoods growing along streamsides and on wet sites.

1D25XØ OPEN DECIDUOUS THORN FOREST WITH CLOSED LOWER LAYERS. . . . . .

ex. Deciduous forest with the trees bearing thorns and usually small leaves. The lower layers consisting of shrubs, dwarf shrubs and grasses. Mesquite forest with lower layers of catclaw, arroweed and grasses.

E CLOSED SCRUB WITH SCATTERED TREES

1 EVERGREEN (At least the shrub layer with no significant leafless period)

1E12XØ CLOSED EVERGREEN SCLEROPHYLL SCRUB WITH SCATTERED TREES. . . . . 

ex. Evergreen scrub with hardened leaves forming a closed layer. Scrub not the trees dominating the landscape. Stands of Quercus turbenella with scattered pinyon pines

1E11XØ CLOSED EVERGREEN SCRUB WITH SCATTERED TREES. . . 

ex. Closed shrub layer. The shrubs with normal size soft leaves. The shrubs and not the trees dominating the vegetation. May not exist at Grand Canyon. An example would be mesic chaparral with scattered pinyon pines.

1E13XØ MICROPHYLLOUS EVERGREEN SCRUB WITH SCATTERED TREES. . . . . 

ex. Shrubs with small leaves, usually gray or gray green in color or else of normal color but hardened. Artemisia tridentata or Cercocarpus ledifolius with scattered pinyon-juniper.

2 SHRUBS DECIDUOUS (At least the shrub layer bare of leaves during the hot season or during the winter)

1E21XØ DECIDUOUS ORTHOPHYLL SCRUB WITH SCATTERED TREES. . . . . 

ex. Shrubs with normal size soft leaves with scattered trees. Quercus gambelii with scattered ponderosa pine.

F DWARF SCRUB WITH SCATTERED TREES (Scrub layer closed)

1 SCRUB EVERGREEN (At least the shrubs without a significant leafless period)

1F13XØ GRAY EVERGREEN DWARF SCRUB WITH SCATTERED TREES. .
ex. The dwarf scrub equivelent of 1E13XØ. Artemisia tridentata growing on less than optimum sites with scattered pinyon-juniper. Often fire sucessional.

J LOW SAVANNA (Herbaceous vegetation less than 1 m tall, with scattered trees)

1 TREES EVERGREEN (At least the tree layer without significant leafless period)

1J13X1 EVERGREEN NARROW SCLEROPHYLL CONICAL CROWN LOW SAVANNA. . . . . 
ex. Closed stand of low plants with scattered evergreen trees. The trees with conical or spire-shaped crowns. This vegetation is found in areas of heavy snow loading. Spruce-fir invasions of meadows.

1J13X2 EVERGREEN NARROW SCLEROPHYLL OVAL CROWN LOW SAVANNA. . . . . 
ex. Closed stand of low plants with scattered evergreen trees. The trees with oval crowns. This vegetation found in areas with moderate snow loads. Ponderosa pine with closed shrub and herbaceous layers. Often fire sucessional.

1J13X3 EVERGREEN NARROW SCLEROPHYLL WIDE CROWN LOW SAVANNA. . . . . 
ex. Closed stand of low plants with scattered evergreen trees. The trees with wide spreading crowns. This vegetation found in areas without significant snow loads. Pinyon-juniper with a closed stand of snakeweed and rabbit brush. Often sucessional following disturbance.

K SHRUB SAVANNA (Closed grass or other herbaceous vegetation with scattered shrubs)

1 SHRUBS EVERGREEN (At least the shrub layer evergreen)

1K13AØ RESINOUS EVERGREEN NARROW SCLEROPHYLL SHRUB SAVANNA. 4

ex. Coniferous shrubs, resinous in nature with a herbaceous (often grass) layer which is closed. Differentiation is not made here between different shub crown shapes since these do not control vegetation type distribution. Ponderosa pine forest regeneration following fire.

1K13BØ NON-RESIONOUS EVERGREEN NARROW SCLEROPHYLL SHRUB SAVANNA. 9

ex. Coniferous shrubs, non-resinous in nature with a closed (often grass) herbaceous layer. Junipers growing in arid grassland.

2 SHRUBS DECIDUOUS (At least the shrub layer bare of leaves in the dry season or in winter)

1K21XØ DECIDUOUS ORTHOPHYLL SHRUB SAVANNA. . . . ⊥

ex. Deciduous shrubs with normal size soft leaves with a closed herbaceous layer. Aspen sucessional following very severe fire.

M SHORT GRASS (Closed herbaceous vegetation, less than 1 m tall, predominatly graminoid)

2 VEGETATION SEASONAL (Vegetation dies back in the hot season or during the winter)

1M21XØ SEASONAL SHORT GRASS ORTHOPHYLL MEADOW. . . ⩢

ex. Closed stand of grasses that die-back in the winter. The grasses are soft in texture. Parks on the North Rim.

N BROAD-LEAFED HERB VEGETATION (Closed vegetation, predominantly of broad-leafed herbaceous plants)

2 VEGETATION SEASONAL (Vegetation dies back in the hot season or during the winter)

1N21XØ SEASONAL BROAD-LEAFED MEADOW. . . . . ⊔

ex. Closed stand of herbacous plants that die-back in the winter. Wild strawberry, larkspur and Potentilla growing near Kanabownits Spring.

P SUBMERGED MEADOWS (Vegetation of rooted aquatic herbs, adapted for permanent complete submersion (at least of the shoots).

1P21XØ SEASONAL WATERGRASS. III
ex. Submerged graminoid vegetation. Cattail communities at Hearst Tanks and various places along the Colorado River.

2 OPEN VEGETATION (Plants or tufts of plants not touching but crowns not separated by more than their diameters; plants, not substratum, dominate the landscape)

A STEPPE FOREST (Often called woodland or woodland-savanna. Tree layer and lower layers open, lower layers may be open or sparse)

1 EVERGREEN STEPPE FOREST (Tree layers, at least, without significant leafless period)

2A14A1 RESINOUS EVERGREEN NARROW SCLEROPHYLL CONICAL CROWN STEPPE FOREST. . . . . 
ex. Trees resinous in nature, their crowns spire or conical in shape as an adaptation for shedding heavy snow loads. Tree boles essentially unbranched. Spruce-fir forests growing on less than optimum sites.

2A14A2 RESINOUS EVERGREEN NARROW SCLEROPHYLL OVAL CROWN STEPPE FOREST. . . . . 
ex. Trees resinous in nature, their crowns roughly oval in shape. Less well adapted to shedding snow than 2A14A1. Ponderosa forest, typical quality sites.

2A14A3 RESINOUS EVERGREEN NARROW SCLEROPHYLL WIDE CROWN STEPPE FOREST. . . . . 
ex. Trees resinous in nature, their boles repeatedly bran ed giving rise to wide spreading crowns poorly adapted for shedding snow. The lower layers almost always sparse. Pinyon and pinyon-juniper forests.

2A14BØ NON-RESINOUS EVERGREEN NARROW SCLEROPHYLL STEPPE FOREST. . . . . 
ex. Non-resinous evergreen forest. May or may not be coniferous. Examples at Grand Canyon are open juniper forest or tall open stands of tamarisk on the Colorado River.

2 DECIDUOUS STEPPE FOREST (Tree layers, at least, with a leafless season in the hot season or in winter)

2A21X1 DECIDUOUS ORTHOPHYLL NARROW CROWN STEPPE FOREST. . . . . 
ex. Trees with normal size soft leaves, their boles essentially unbranched, giving a narrow crown suited to shedding snow. Aspen stands on typical sites.

2A21X2 DECIDUOUS ORTHOPHYLL WIDE CROWN STEPPE FOREST. . . . . 
ex. Trees with normal size soft leaves, their boles repeatedly branched, giving a wide spreading crown, unsuited to shedding snow. Typical stands of cottonwood.

2A24XØ DECIDUOUS THORN STEPPE FOREST. . . . . 
ex. Trees bearing thorns and often microphyllous leaves. Mesquite trees on typical sites.

B STEPPE SCRUB (Like steppe forest, but with shrubs (over 0.5 m tall) instead of trees)

1 EVERGREEN STEPPE SCRUB (Shrub layer at least, evergreen)

2B12XØ EVERGREEN BROAD SCLEROPHYLL STEPPE SCRUB. . . . . 
ex. Shrubs with normal size but hard leaves. Manzanita or buffalo berry on xeric sites.

2B14AØ GREEN EVERGREEN MICROPHYLLOUS STEPPE SCRUB. . . . . 
ex. Open phases of chaparral below canyon rims.

2B14BØ GRAY EVERGREEN MICROPHYLLOUS STEPPE SCRUB. . . . . 
ex. Shrubs with soft gray green leaves. Artemisia tridentata on typical sites.

2B15XØ EVERGREEN SUCCULENT STEPPE SCRUB. . . . . 
ex. Shrubs with fleshy leaves, often an adaptation for growth on saline soils. Sarcobatus stands.

2B16XØ EVERGREEN SALTBUSH STEPPE SCRUB. . . . .
ex. Shrubs with gray scurfy leaves, often growing on saline soils.

2B17XØ RESINOUS EVERGREEN NARROW SCLEROPHYLL STEPPE SCRUB. . . . . 
ex. Shrubs of a resinous nature, usually coniferous reproduction. No distinction is made regarding crown shape since this feature has no significance in distribution.

2 DECIDUOUS STEPPE SCRUB (Shrub layer bare of leaves during the hot season or in the winter)

2B21XØ DECIDUOUS ORTHOPHYLL STEPPE SCRUB. . . . . 
ex. Shrubs with soft normal size leaves. Aspen reproduction or typical stands of Quercus gambelii.

C DWARF STEPPE SCRUB (Open predominantly woody vegetation less than 0.5 m tall)

1 EVERGREEN DWARF STEPPE SCRUB (At least dwarf scrub evergreen)

2C11XØ EVERGREEN ORTHOPHYLL DWARF STEPPE SCRUB. . . . . 
ex. Mesic phases of chappara

2C12XØ EVERGREEN BROAD SCLEROPHYLL DWARF STEPPE SCRUB. . . . . 
ex. Manzanita or buffaloberry on the poorest sites.

2C13XØ EVERGREEN NARROW SCLEROPHYLL DWARF STEPPE SCRUB. . . . . 
ex. Usually reproduction of coniferous species but would apply also to tamarisk.

2C14XØ MICROPHYLLOUS EVERGREEN DWARF STEPPE SCRUB. . . . . 
ex. Small shrubs with small leaves that are soft in texture. Artemisia on poor sites.

2 DECIDUOUS DWARF STEPPE SCRUB (Shrub layer bare of leaves during hot season or in winter)

2C11XØ DECIDUOUS ORTHOPHYLL DWARF STEPPE SCRUB. . . . . .
ex. Low shrubs with normal size soft leaves. Initial stages of aspen reproduction.

D STEPPE SAVANNA (Steppe with scattered trees)

1 EVERGREEN STEPPE SAVANNA (Trees evergreen)

2D12X1 EVERGREEN NARROW SCLEROPHYLL CONICAL CROWN STEPPE SAVANNA. . . . . .
ex. Scattered trees with conical crowns, lower layers open and herbaceous. Spruce-fir species in open grasslands. Probably quite uncommon at Grand Canyon.

2D12X2 EVERGREEN NARROW SCLEROPHYLL OVAL CROWN STEPPE SAVANNA. . . . . .
ex. Scattered trees with oval crowns, lower layers open and herbaceous. Ponderosa pine in dry park settings.

2D12X3 EVERGREEN NARROW SCLEROPHYLL WIDE CROWN STEPPE SAVANNA. . . . . .
ex. Scattered trees with wide crowns, lower layers open and herbaceous. Pinyon and junipers in open grasslands.

2 DECIDUOUS STEPPE SAVANNA (Trees deciduous)

2D21XØ DECIDUOUS ORTHOPHYLL STEPPE SAVANNA. . . . .
ex. Trees with soft normal size leaves scattered over predominately herbaceous vegetation, open to sparse. Probably rare at Grand Canyon.

2D24XØ DECIDUOUS THORN STEPPE SAVANNA. . . . . .
ex. Trees scattered, lower layers open and herbaceous. Trees with thorns and usually with microphyllous leaves. Mesquite in open grassland.

E SHRUB STEPPE SAVANNA (Steppe with scattered shrubs)

1 EVERGREEN SHRUB STEPPE SAVANNA (Shrubs evergreen)

2E12XØ EVERGREEN SCLEROPHYLL SHRUB STEPPE SAVANNA. . . . .
ex. Shrubs with hardened leaves (may be narrow or broad), lower layers open. Desert grassland with juniper or yucca.

2E13XØ EVERGREEN MICROPHYLL SHRUB STEPPE SAVANNA. . . . . 
ex. Scattered shrubs with small leaves, lower layers open and herbaceous. Creosote bush flats.

2E14XØ EVERGREEN SUCCULENT SHRUB STEPPE SAVANNA. . . . . 
ex. Shrubs fleshy or succulent, scattered among open herbaceous plants. Agave or Opuntia (ours with cylindrical stems) scattered over desert grassland.

2 DECIDUOUS SHRUB STEPPE SAVANNA (Shrubs bare of leaves during hot season or in winter)

2E23XØ MICROPHYLLOUS DECIDUOUS SHRUB STEPPE SAVANNA. . . . . 
ex. Shrubs with small leaves and often bearing thorns scattered over desert grassland. Mesquite on xeric flats.

F DWARF SHRUB STEPPE SAVANNA (Steppe with scattered dwarf shrubs)

1 EVERGREEN DWARF SHRUB STEPPE SAVANNA (Dwarf shrubs evergreen)

2F12XØ EVERGREEN SCLEROPHYLL DWARF SHRUB STEPPE SAVANNA. . . . . 
ex. Dwarf shrubs with hardened leaves scattered over desert grassland. Juniper in poor sites.

2F13XØ SUCCULENT DWARF SHRUB STEPPE SAVANNA. . . . 
ex. Scattered succulent dwarf shrubs in desert grassland. Opuntia, Ferrocactus and other cacti in desert grassland. The sites often quite rocky.

2 DECIDUOUS DWARF SHRUB STEPPE SAVANNA (Dwarf shrubs dropping many of their leaves (but not all) during hot season)

2F21XØ SEASONAL SCLEROPHYLL DWARF SHRUB STEPPE SAVANNA. . . . . 
ex. Dwarf shrubs with hardened and usually small leaves scattered in desert grassland. Coleogyne or Franseria on better sites.

I OPEN SUBMERGED MEADOWS (Shoots at least covered by water)

2I21XØ OPEN SEASONAL WATERGRASS. . . . . 
ex. Graminoid plants growing in open stands. Open phases of cattail swamps.

3 SPARSE VEGETATION OR DESERT (Plants so scattered that substratum dominates the landscape)

A DESERT FOREST (Scattered trees, subordinate shrub or herb layers very sparse or absent)

1 EVERGREEN DESERT FOREST (May be evergreen because of persistent leaves or because of green stems)

3A11XØ EVERGREEN NON-SUCCULENT DESERT FOREST. . . . . 
ex. scattered evergreen trees, often along dry watercourses. Trees may be deciduous in the coldest winters. Probably rare at Grand Canyon.

2 DECIDUOUS DESERT FOREST (May not be winter deciduous)

3A21XØ MICROPHYLLOUS DECIDUOUS DESERT FOREST. . . . . 
ex. Trees with small leaves, often bearing thorns. Mesquite desert.

B DESERT SCRUB (Scattered shrubs in an otherwise bare or only ephemerally vegetated landscape, not here differentiated into shrub and dwarf shrub classes)

1 EVERGREEN DESERT SCRUB (Shrubs evergreen)

3B12XØ MICROPHYLLOUS EVERGREEN DESERT SCRUB. . . . . 
ex. Very scattered usually low shrubs, lower layers usually ephemeral. Larrea, Coleogyne or Franseria desert.

2 DECIDUOUS DESERT SCRUB (Shrubs deciduous)

3B22XØ DECIDUOUS DESERT THORN SCRUB. . . . . .
ex. Scrub species showing great adaptation for desert survival. Thorns usually present. Leaves often deciduous during the hot season or ephemerally deciduous. Fouquieria-Acacia gregii desert.

C DESERT HERB VEGETATION (Scattered herbaceous plants only)

3C22XØ EPHEMERAL HERB DESERT. . . . . .
ex. Vegetation principally of ephemeral annual and geophytes, appearing only for short periods after rains.

APPENDIX J

PRIOR CONSULTATION AND COORDINATION SUMMARY

Consultation and coordination on wilderness recommendations have been underway on the Lake Mead National Recreation Area since 1974, and on the Grand Canyon Complex since 1971. The information gathered during this period is reviewed in this section since a good portion of it has been incorporated in developing the current preliminary wilderness proposal for the enlarged Grand Canyon National Park.

GRAND CANYON COMPLEX 1972 WILDERNESS RECOMMENDATION

The Consultation and Coordination of the Final Environmental Statement, Proposed Wilderness Classification, Grand Canyon Complex (FES 73-68) describes consultation with other agencies. coordination and consultation with the public. The following is provided as a historic review of the 1971 effort.

CONSULTATION AND COORDINATION IN THE DEVELOPMENT OF THE PROPOSAL AND IN THE PREPARATION OF THE DRAFT ENVIRONMENTAL STATEMENT

Public hearings on the preliminary wilderness proposal were held in Phoenix, Arizona on May 15, 1971, and in Grand Canyon National Park on May 18, 1971. In addition, public comment was requested by legal notice in the local newspapers of Williams, Arizona, Flagstaff, Arizona, and Kanab, Utah. The preliminary packet was mailed to organizations and individuals to solicit their comments and/or attendance at the public

meetings. The proposal was also available for public inspection at the following locations: Grand Canyon National Park, National Park Service Southwest Regional Office, and in the National Park Service offices in Washington, D.C. The proposal has been coordinated with the Bureau of Indian Affairs through correspondence and meetings of the Park Superintendent and the BIA. The Bureau of Reclamation was contacted, but their correspondence indicated that the wilderness proposal would have minimal impact upon Reclamation programs and activities. In addition, the authority to construct dams within the Grand Canyon Complex can only be invoked by Congressional action. As a result, further coordination with the Bureau of Reclamation was not considered to be necessary.

Of the 1,097 public responses to the preliminary wilderness study, 23 favored a no-wilderness designation. This group of no-wilderness supporters is comprised of: certain Indians who would prefer more intensive land use adjacent to them; people concerned about water resource potentials and the foreclosure of dam projects; and business-oriented interests who see curtailment of commercial ventures on lands outside the park because wilderness designation will not cause an extensive influx of people.

The Sierra Club, the Wilderness Society, and a number of national and local conservation organizations presented similar proposals that recommended that an additional 11 areas, totaling 345,205 acres, be added to proposed wilderness units. These additions would result in a two-unit Grand Canyon wilderness, consisting of an eastern unit of 241,285 acres

and a western unit of 609,220 acres. The nonwilderness utility corridor along the Bright Angel and North Kaibab Trails dividing the two units, would be narrowed, resulting in an addition of 11,310 acres. Inclusion of Havasu Canyon and its tributaries above Mooney Falls, except Havasupai Campground, would add 68,200 acres to wilderness.

The largest proposed addition would involve 113,880 acres in Grand Canyon National Monument, and include portions of the pinyon/juniper forest on the Kanab Plateau and the Esplanade below the canyon rim. This area was excluded from the National Park Service proposal because of the existence of livestock grazing. The conservation groups' position is that established grazing is permissible under the provisions of the Wilderness Act, and should not be the basis for exclusion of lands from wilderness. An additional 20,690 acres in the Toroweap Valley area is also recommended.

Their proposal also suggests that the Colorado River should be included in wilderness, despite the continued use of motorized rafts, because they feel that the use of motors is permissible under the terms of the Wilderness Act. A number of groups also recommended that motor-powered trips down the river be discontinued.

The National Parks and Conservation Association presented a similar proposal, and recommended that wilderness be extended to one side of all existing public roads within the park, with a 1/8-mile buffer zone flanking the other side of the road.

The State of Arizona concurred in proposed Wilderness Units 1-6, but recommended that Unit 7 in the Mount Emma area be transferred to Lake

Mead National Recreation Area, so as to allow hunting in that area.

The Navajo Nation was opposed to the proposed Wilderness Unit 2. They raised the question of their use and occupancy rights on the east side of Marble Canyon under the 1934 Boundary Act, which retained for the Navajo Nation the right of use and occupancy on withdrawn land until the land "shall be required for power purposes or other uses under the authority of the United States." It is their contention that the right of use and occupancy granted by the 1934 statute continues in full force and effect.

The Havasupai Tribe supported the National Park Service proposal because it did not include the grasslands in the Great Thumb area and on the Tenderfoot Plateau that they now use for livestock grazing.

Aircraft operators in the tri-state area of Nevada, Utah, and Arizona spoke at the wilderness hearings, although their comments did not directly support or oppose the National Park Service proposal. They believe that many of the visitors who fly the Grand Canyon will never set foot within the park. They think their flights provide an immense service and a great scenic and wilderness experience to these persons, and recommend that aircraft continue to be allowed to fly below the rims of Grand Canyon.

Requests for written responses and public testimony at the public hearings resulted in participation from the following organizations:

State of Arizona, Governor
State of Nevada, Colorado River Commission
State of Utah, Office of the Governor
U.S. Department of Agriculture, Deputy Chief, Forest Service

U.S. Department of the Army, Corps of Engineers, Los Angeles District
U.S. Department of Commerce, Administrator, National Oceanic and Atmospheric Administration
U.S. Department of the Interior
Geological Survey
Bureau of Indian Affairs
Bureau of Mines
Bureau of Outdoor Recreation
Bureau of Sport Fisheries and Wildlife
U.S. Department of Transportation
Federal Power Commission
Aircraft Owners and Pilots Association
American Camping Association, Central Arizona District
Appalachian Mountain Club, Boston, Massachusetts
Arizona Academy of Science
Arizona Conservation Council
Arizona Mountaineering Club
Arizona Wildlife Federation
Arizonans for Quality Environment (AWWW)
Arizonans in Defense of the Environment
Bluff City Cave Club, Memphis, Tennessee
Pennsylvania Environmental Action/Zero Population Growth, Pittsburgh, Pennsylvania
Pueblo Audubon Society, Pueblo, Colorado
Save the Grand Canyon Committee, Albuquerque, New Mexico
Seattle Audubon Society, Seattle, Washington
Sierra Club (Southwest Region)
Sierra Club, Huron Valley Group, Ann Arbor, Michigan
Sierra Club, New England Chapter
Sierra Club, Plateau Group
Sierra Club, Prairie Chapter, Illinois
Sierra Club, Rio Grande Chapter, New Mexico
Sierra Club, Tulsa, Oklahoma Group
Southern Arizona Hiking Club
Student Coalition Against Pollution, Tulsa, Oklahoma
Student Council on Pollution and the Environment, Pacific Southwest Region
Swan Citizens Conservation Council, Condon, Montana
Tri-State Operators Association
Tucson Audubon Society
Tucson Wildlife Unlimited, Inc.
Wasatch Mountain Club, Salt Lake City, Utah
Wilderness Society
Wilderness Workshop of Colorado

LAKE MEAD NATIONAL RECREATION AREA WILDERNESS PROPOSAL 1974

The Draft Environmental Statement for Proposed Wilderness Areas, Lake Mead National Recreation Area, Arizona and Nevada (DES 74-3) lists agencies

and individuals consulted and lists agencies provided with a copy of the document for purposes of coordination.

CONSULTATION AND COORDINATION IN THE DEVELOPMENT OF THE PROPOSAL AND IN THE PREPARATION OF THE DRAFT ENVIRONMENTAL STATEMENT

The following organizations and indivuduals were consulted during the development of the proposal and/or in the preparation of the draft environmental statement:

Department of the Interior
- Bureau of Land Management
- Bureau of Indian Affairs
- Bureau of Reclamation
- Geological Survey

Arizona Game and Fish Department
Arizona State Park Department
Nevada Fish and Game Commission
Nevada State Park System
State Office of the Bureau of Land Management

Clark County, Planning Commission, Nevada
Hualapai Indian Tribal Council
Mohave County, Planning Commission, Arizona

Dr. Glen W. Bradley, Nevada Southern University
Dr. Fritz Went, Desert Research Institute, Nevada

The above agencies and organizations, with the exception of the Bureau of Land Management, the Bureau of Reclamation, Arizona Game and Fish Department, Nevada Fish and Game Commission, and the Mohave County Planning Commission, preferred to await the formal release of the preliminary wilderness study before offering comments.

Various interests, such as the local chapters of the National Audubon Society and the Sierra Club, wished to review the proposal with their

respective members and present collective responses during the public hearings to be held February/March 1974. The chairman of the Hualapai Indian Tribal Council also expressed a similar need.

Formal and informal contacts between the National Park Service and the following agencies revealed areas of specific concern.

The Bureau of Land Management discussed water development problems within wilderness and the effects of wilderness on their grazing management program. Periodic maintenance of water catchments and spring improvements would not be restricted by wilderness designation.

The Bureau of Reclamation was concerned about the withdrawal of lands for management corridors, future rights-of-way, areas of security around the two dams, and the 300-foot setback. A recommendation was made to exclude powerline corridors in order to preserve wilderness integrity.

The State Fish and Game Commission, Nevada and the State Game and Fish Department, Arizona both expressed the need to preserve bighorn sheep habitat and indicated that wilderness designation would eliminate the threat of year-round vehicle intrusion in the bighorn range.

The Mohave County Planning Commission discussed the possibility of the North-South transit route through the Grand Wash Cliffs area and the preclusion of the project if the area were included in the wilderness proposal.

The U.S. Geological Survey is presently completing topographic mapping of the Shivwits and Sanup Plateaus. No problems arose concerning their program in relation to the wilderness proposal.

PUBLIC HEARINGS

The following is a synopsis of public hearings conducted for the preliminary wilderness proposal for Lake Mead National Recreation Area:

As required by the Wilderness Act, public hearings were held on the Lake Mead National Recreation Area preliminary wilderness proposal at Kingman, Arizona, on 28 March 1974, and at Las Vegas, Nevada, on 30 March 1974. (The preliminary wilderness study is included in the appended Hearing Officer's Report.) Notice of the hearings appeared in the Federal Register on 28 February 1974, and also in newspapers in the general vicinity of the recreation area. Approximately 50 people attended the Kingman hearing, and 19 oral statements were presented. Approximately 56 people attended the Las Vegas hearing, and 24 oral statements were presented. Oral statements, letters, and signatures on petitions accounted for a total of 505 responses.

Of the public agencies, private organizations, and individuals testifying or submitting written views, and individuals signing petitions, none of the 14 public agencies, 3 of the 57 organizations, and 64 of the 434 individuals supported the preliminary wilderness proposal. Forty-three of the organizations and 354 of the individuals favored more wilderness. Five public agencies favored less wilderness. Two public agencies, 1 organization, and 4 individuals favored wilderness, but had no specific recommendation. Four public agencies, 9 organizations, and 11 individuals opposed wilderness. Two public agencies, one organization, and one individual had no position on the preliminary wilderness proposal. One agency responded only to the environmental impact statement, with no position

on the preliminary wilderness proposal. The recommendations by others are described in the appended Hearing Officer's Report.

Careful study of the oral and written statements received during the public hearings, written statements received during the time the hearing record was open, and further management considerations resulted in the revisions to the preliminary wilderness proposal.

APPENDIX K

WILDERNESS TEAM PERSONNEL

National Park Service personnel who may be contacted for information on the Wilderness Proposal and its Draft Environmental Statement:

TERRY R. CARLSTROM
Team Captain - Wilderness Coordinator
Denver Service Center

JON F. HAMAN
Environmental Specialist
Denver Service Center

DAVID C. OCHSNER
Chief, Division of Resource Management
Grand Canyon National Park, Arizona

Publication services were provided by the graphics staff of the Denver Service Center. NPS 1050